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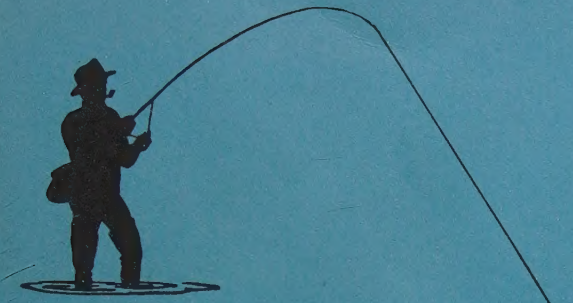

SPORT FISHERY ABSTRACTS

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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12484. Cairns, John, Jr., Kenneth L. Dickson, Richard E. Sparks, and William T. Waller (Bio. Dept., Virginia Polytechnic Inst., Blacksburg, Virginia). 1970. A PRELIMINARY REPORT ON RAPID BIOLOGICAL INFORMATION SYSTEMS FOR WATER POLLUTION CONTROL. J. Wat. Poll. Control Fed., Part 1, pp. 685-703.

Preliminary results of tests of one in-stream and two in-plant biological monitoring systems indicate that the time required to generate biological information pertinent to pollution control may be reduced substantially. The in-stream monitoring system described provides information on the condition of a stream community much more rapidly than traditional methods. The movements, breathing, and EKG of fish warn of aberrant function before death and provide additional information concerning the general "health" of the fish. Movement and physiological patterns may change at toxicant concentrations that are undetectable by traditional bioassays. Certain aspects of the in-plant monitoring systems may be adaptable to an in-stream system by use of biotelemetry. (From authors summ.)

12485. Swingle, H. S. (Agricultural Experiment Sta., Auburn University, Auburn, Alabama). 1966. STANDARDIZATION OF BIOLOGICAL METHODS IN FISH CULTURE RESEARCH. Reprinted from Proc. World Symposium on Warm-Water Pond Fish Culture, Italy, May 18-25, 1966; FAO Fisheries Report 44(4): 422-429, 1968.

For population analysis, it is recommended that relationships be computed relating total length to weight, to maximum body depth, to maximum body width and to mouth width. Measurement of weight should be in grams and length, depth, and mouth width measurements in millimeters. It is further recommended that condition of fish be expressed as relative condition, calculated by dividing the observed weight of fish of a certain length by the standard average weight for this length, calculated from data supplied from all countries where this species is cultured. It is recommended that for reporting populations and for construction of length-weight tables, the total length data be consolidated into cm-groups, using odd numbers to express the mid-point between 2 cm intervals. Thus the 5-cm group would be those fish whose total length varied from more than 4 cm up to and including 6 cm. The need exists for a standard method of evaluating the yield and efficiency in food conversion of all fishes that are or appear to be useful in pond fish culture. It is recommended that this be done in a standard 120-day experimental period with a species at three levels of stocking in unfertilized ponds, in fertilized ponds and in ponds where fish are artificially fed. It is recommended that the fish stocked be in the 7-cm group, that fertilization be by superphosphate and that feeding be at the 3 percent level re-adjusted bi-weekly. It is recommended that a list of accepted common names of fishes used in pond culture be compiled in the three official languages of FAO, namely English, French and Spanish. Because of the rapid obsolescence of scientific names in the tilapias as well as other species, a need exists for a numbering system so that future readers of current literature may know the exact species used. It is suggested that the present scientific name be followed by coded numbers giving the continent, the country, the river system watershed and the date when first obtained from this habitat. Thus a fish Tilapia macrochir II 05021956 might indicate a fish from Africa (II), from Congo (05), in Ubangi River watershed (02), in the year 1956. (Auth.)

12486. Williams, James D., and C. Richard Robins (Dept. of Biology, Univ. of Alabama, University, Alabama). 1970. VARIATION IN POPULATIONS OF THE FISH Cottus carolinae IN THE ALABAMA RIVER SYSTEM WITH DESCRIPTION OF A NEW SUBSPECIES FROM BELOW THE FALL LINE. Amer. Midl. Nat., 83(2): 368-381.

12487. Campbell, Robert S., and Owen T. Lind (Univ. of Missouri, Columbia, Missouri). 1969. WATER QUALITY AND AGING OF STRIP-MINE LAKES. J. Wat. Poll. Contr. Fed., 41(11, part 1): 1943-1955.

This study describes physical and chemical characteristics of five obviously different strip-mine lakes in order to document changes in water quality with aging. Strip-mine lakes differ from natural lakes in several respects. The initial successional stage is acid rather than classically oligotrophic, and is characterized by low pH, high potential acidity, absence of bicarbonate, and large concentrations of dissolved minerals which produce high conductivity measurements. Sulfate is the predominant anion. Strong colors of red, blue, or green usually characterize the water. These conditions become less pronounced as sulfuric acid pollution ameliorates. During the less acid phase, the lakes are homeothermous. A later alkaline stage appears comparable to stages of early eutrophy in natural lakes.

12488. Olson, Robert E. (Dept. of Zoology and Entomology, Montana State Univ., Bozeman, Montana). 1970. THE LIFE CYCLE OF Cotylurus erraticus (Rudolphi, 1809) Szidat, 1928 (TREMATODA: STRIGEIDAE). J. Parasit., 56(1): 55-63.

The life cycle of the strigeid trematode, Cotylurus erraticus (Rud., 1809) Szidat, 1928, was completed experimentally in the laboratory. Eggs were obtained from laboratory-infected immature Larus californicus. Most eggs hatched in 15 to 16 days at 24 C and the miracidium was similar in morphology to other strigeoid miracidia. Mother and daughter sporocysts developed in the operculate snail, Valvata lewisi, and the pharyngeate, furcocercous cercaria usually emerged 35 days after infection. The metacercaria is tetracotyliform and was originally described as Tetracotyle intermedia. It encysts in the pericardial cavity of salmonid fishes and was found in Salmo gairdneri, Salvelinus fontinalis, Oncorhynchus nerka, O. kisutch, and Thymallus arcticus collected from Georgetown Lake. When ingested by immature gulls, the metacercariae developed in the small intestine to patent adults in 4 days. This study is the first description of the complete life cycle for a fish-infecting Tetracotyle. (Auth.)

12489. Swingle, H. S. (Agricultural Experiment Sta., Auburn Univ., Auburn, Alabama). 1946. EXPERIMENTS WITH COMBINATIONS OF LARGEMOUTH BLACK BASS, BLUEGILLS, AND MINNOWS IN PONDS. Trans. Amer. Fish. Soc., Vol. 76, pp. 46-62.

Various combinations of largemouth bass, bluegills, golden shiners, gizzard shad, and Gambusia were stocked in 0.25-acre experimental ponds. The ponds were fertilized with inorganic fertilizer. After 1 or 2 years the ponds were drained and the fish counted and weighed. The bluegill proved the most desirable forage fish, although it did not result in the highest bass production in these experiments. It appeared to offer promise of the highest sustained yield of bass over a period of years. Golden shiners gave higher bass production for a 1- to 2-year period, but could not maintain high production over a longer period. Goldfish could not be used with bluegills because the latter ate goldfish eggs and prevented reproduction. Goldfish also were not satisfactory when used with bass only, because many young grew too large for bass to eat and ate their own eggs, thus preventing further reproduction. Gizzard shad produced a high poundage of bass, but the young rapidly grew too large for bass to eat and overcrowded the ponds. As a result, they stopped reproducing and at the same time reduced bluegill production. Gambusia were unsatisfactory as forage fish because bass eliminated them almost entirely from ponds in a few months. (Auth.)

12490. Schmittou, H. R. (Agricultural Experiment Sta., Auburn Univ., Auburn, Alabama). 1968. SOME EFFECTS OF SUPPLEMENTAL FEEDING AND CONTROLLED FISHING IN LARGEMOUTH BASS-BLUEGILL POPULATIONS. Reprint from Proc. Twenty-second Ann. Conf., Southeastern Association of Game and Fish Commissioners, October 21-23, 1968 at Baltimore, Maryland, pp. 311-320.

12491. Allison, R., and W. A. Rogers (Agricultural Experiment Station, Dept. of Zoology-Entomology, Auburn Univ., Auburn, Alabama). 1970. MONOGENETIC TREMATODES OF SOME ALABAMA FRESHWATER FISHES WITH DESCRIPTIONS OF FOUR NEW SPECIES AND REDESCRIPTIONS OF TWO SPECIES. Reprint from: Proc. Helminthological Soc. of Washington, 37(1): 17-23.

The following new species of Dactylogyridae are described from Alabama fishes: Actinocleidus bennetti from Lepomis auritus, Urocleidus circumcirrus from Elassoma zonatum, Urocleidus tuberculatus from Lepomis auritus, and Urocleidus udicola from Elassoma evergladei and Elassoma zonatum. Dactylogyrus minutus Kulwiec, 1927, is redescribed for the first time from North America and Actinocleidus georgiensis Price, 1966, is redescribed. In all 43 described species involving six genera and two subfamilies of Dactylogyridae are reported. New host records are reported for 11 of these. (Authors)

12492. Fijan, N. N., and P. R. Voorhees (Dept. of Zoology-Entomology, Auburn Univ., Auburn, Alabama). 1969. DRUG SENSITIVITY OF Chondrococcus columnaris. Veterinarski arhiv, Zagreb, knjiga 39, svezak 9-10, pp. 259-267.

The sensitivity of C. columnaris to 28 antibiotics, 5 nitrofurans, 11 sulfonamides, 5 other chemotherapeutics, 20 disinfectants and 11 other chemicals was assayed and results compared with data pertinent to possible application for treatment of columnaris disease. Commercial paper discs were used in assays with chemotherapeutics. Cultures tested were sensitive to ampicillin, chloramphenicol, cephalothin, chlortetracycline, demethylchlortetracycline, dihydrostreptomycin, erythromycin, lincomycin, methacycline, oleandomycin, oxtetracycline, penicillin, phenethicillin, streptomycin and tetracycline, sulfonamides, nitrofurans, methenamine mandelate, nalidixic acid and trichlobismonium chloride. They were less sensitive to kanamycin and resistant to bacitracin, cloxacillin, colistin, methicillin, nafcillin, neomycin, nystatin, oxacillin, polymyxin B, ristocetin, vancomycin, viomycin, Isoniazid and paraminosalicylic acid. Data on the minimum inhibitory concentrations of disinfectants and some other chemicals obtained by serial tenfold and serial twofold assays were related to the information on their fish toxicity and use in therapy of fish diseases. In this group of chemicals neutral acriflavine seemed to be most promising and formalin, methylene blue, Diquat (herbicide), Dowicil 100 (quaternary ammonium-like compound), 4', acetamido salicylanilide as well as sodium chloride less promising for prolonged or indefinitely prolonged treatment of columnaris disease. Other tested compounds were either less active, or more toxic to fish. Some heavy metal compounds were highly active, but are hazardous in other respects. (Authors conclusion)

12493. Forsbergh, Eric D. 1969. ON THE CLIMATOLOGY, OCEANOGRAPHY AND FISHERIES OF THE PANAMA BIGHT. Inter-American Tropical Tuna Commission Bull., 14(2): 385 p.

The fisheries of the Panama Bight annually produce about 30,000 metric tons of food species and about 68,000 m.t. of species used for reduction. Most attempts to further the understanding of tuna ecology were unsuccessful. The apparent abundances of yellowfin and skipjack in the northern part of the Bight appear to be related to the seasonal cycle of upwelling and enrichment, as abundances are greatest in April and May when food appears to be plentiful. The life-cycle of the anchoveta in the Gulf of Panama also appears to be related to upwelling; the species mass varies from about 39,000 m.t. in December to about 169,000 m.t. in April. About 19.1×10^{12} anchoveta eggs are spawned annually. The life-cycles of shrimp in the Panama Bight appear to be related to upwelling as catches are greatest in May-July, about 3-5 months after peak upwelling, and annual catches are inversely correlated with sea level. (From auth.)

12494. Brown, C. J. D. 1968. BIBLIOGRAPHY OF MONTANA FISHES. Proc. of the Montana Academy of Sciences 28: 85-95.

12495. Anderson, R. Stewart (Canadian Wildlife Serv., Univ. of Calgary Campus, Calgary, Alberta, Canada). 1970. EFFECTS OF ROTENONE ON ZOOPLANKTON COMMUNITIES AND A STUDY OF THEIR RECOVERY PATTERNS IN TWO MOUNTAIN LAKES IN ALBERTA. J. Fish. Res. Bd. Canada, 27(8): 1335-1356.

The devastation and recovery of the zooplankton communities were studied in conjunction with the application of rotenone to two mountain lakes in Jasper National Park. Crustacean plankters were absent for about 6 months after treatment, but rotifers and net phytoplankton were never completely absent. All crustacean species except one reached prerotenone abundance in about 3 years, probably the minimum time for recovery in these lakes. The speed of recovery is likely related to fecundity, time of reproduction, and the presence of resistant stages. Diaptomus sicilis had not reached reproductive maturity when rotenone was applied, and it was the last species to recover to its original numbers. Some species not found in samples before application were found in small numbers afterwards, probably due in part to movement from the littoral into the limnetic zone. In both lakes, blooms of small cladocerans after treatment were soon supplanted by increases in large cladoceran numbers. Most variations in composition and abundance after rotenone were likely due to changes in competition and predation pressures rather than to changes in environmental factors or to direct effects of rotenone. (Auth.)

12496. Fletcher, G. L., R. J. Hoyle, and D. A. Horne (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1970. YELLOW PHOSPHORUS POLLUTION: ITS TOXICITY TO SEAWATER-MAINTAINED BROOK TROUT (Salvelinus fontinalis) AND SMELT (Osmerus mordax). J. Fish. Res. Bd. Canada, 27(8): 1379-1384.

Yellow phosphorus was lethal to seawater-maintained brook trout and smelt at concentrations as low as 0.5 μg/liter. Trout that were exposed to low concentrations of yellow phosphorus (0.5 and 7.0 μg/liter) for 50 or more hours turned red and showed signs of extensive hemolysis. At death, all trout that had been exposed to 104 μg/liter yellow phosphorus and lower had hematocrits that were significantly lower than those of the controls. (Authors)

12497. Amend, Donald F., and Velma C. Chambers (Bur. of Sport Fisheries and Wildlife, Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Wash.). 1970. MORPHOLOGY OF CERTAIN VIRUSES OF SALMONID FISHES. II. IN VIVO STUDIES OF INFECTIOUS HEMATOPOIETIC NECROSIS VIRUS. J. Fish. Res. Bd. Canada, 27(8): 1385-1388.

Juvenile sockeye salmon (Oncorhynchus nerka) were injected with the infectious hematopoietic necrosis (IHN) virus, and tissue samples from the anterior kidney, spleen, liver, intestine, and pyloric caeca of moribund fish were prepared for electron microscopy. Bullet-shaped virus particles measuring 158 x 90 mμ were observed in the hematopoietic tissues of the anterior kidney and spleen. Virus particles were also observed in the outer connective tissues of the pancreas or pyloric caeca, or both. No virus was found in the intestine or liver. The healthy appearance of erythrocytes, reticular cells, and endothelial cells in necrotic areas of the spleen and anterior kidney, and the absence of lymphocytes in these areas, suggested that lymphocytes might be one source of the virus. (Authors)

12498. Anderson, Douglas P., and George W. Klontz (Bur. of Sport Fisheries and Wildlife, Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Wash.). 1970. PRECIPITATING ANTIBODY AGAINST Aeromonas salmonicida IN SERUMS OF INBRED ALBINO RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 27(8): 1389-1393.

Precipitins in albino rainbow trout serums were demonstrated by gel diffusion after a single parenteral exposure to the soluble antigens of Aeromonas salmonicida. The fraction of the serum containing antibody activity against the presented antigens was shown by immunoelectrophoresis to be in the nonmigrating region. This corresponded to the beta-2 fraction of rabbit serum. An antibody-containing component comparable with rabbit gamma globulin was not detected. (Authors)

12499. Hargrave, B. T., and G. H. Geen (Dept. of Biol., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1970. EFFECTS OF COPEPOD GRAZING ON TWO NATURAL PHYTOPLANKTON POPULATIONS. J. Fish. Res. Bd. Canada, 27(8): 1395-1403.

Feeding and filtration rates of four species of copepods (Pseudocalanus minutus, Temora longicornis, Oithona similis, and Acartia tonsa) from Bras d'Or Lake and Morrison's Pond, Cape Breton Island, N. S., were measured in the laboratory with natural populations of phytoplankton. Adult copepods ingested all sizes of flagellates (1-15 μ in maximum dimension) but 5-15-μ cells were removed most efficiently. Ceratium sp. and Chaetoceros sp., principal spring and winter forms, were not utilized. Feeding rate declined as the number of animals per liter and the duration of the experiment increased. Estimates of feeding rates in nature were derived by extrapolation from the results of laboratory experiments. A comparison of estimates of mean summer primary production at the depths of maximum photosynthesis and daily zooplankton food intake suggested that, at those depths, zooplankton in Bras d'Or Lake consumed all the average daily production whereas 66% was removed in Morrison's Pond. The remaining production in Morrison's Pond probably contributed to the support of large rotifer and ciliate populations not found in Bras d'Or Lake. Natural concentrations of flagellates were more than sufficient to meet copepod respiratory energy requirements under laboratory conditions. (Authors)

12500. Sparling, J. H., and C. Nalewajko (Dept. of Botany, Univ. of Toronto, Toronto, Ontario, Canada). 1970. CHEMICAL COMPOSITION AND PHYTOPLANKTON OF LAKES IN SOUTHERN ONTARIO. J. Fish. Res. Bd. Canada, 27(8): 1405-1428.

Water chemistry in southern Ontario lakes is determined primarily by surface and bedrock geology and the impact of cultivation. In areas of uniform bedrock, elevation and lake size are shown to be important. Total dissolved solids give a poor indication of the electrolyte content of lakes, because of the varied geology. Four main lake types are recognised: (1) base-poor lakes, frequently dystrophic, found on the Precambrian shield; (2) moderately base-rich lakes, in the Bancroft-Rideau lakes region, related to the frequent occurrence of more easily weathered rocks; (3) base-rich lakes found in the limestone region south of the shield, and receiving abundant drainage from cultivated land; and (4) base-rich lakes with high levels of magnesium draining from Silurian dolomitic limestone bedrock and dolomite-rich glacial tills. Phytoplankton populations were found to be related in part to the chemical composition of lake waters. Certain species such as Tabellaria flocculosa and to a lesser extent Asterionella formosa and Dinobryon divergens were associated mainly with base-poor lakes; a far larger number of species, including Synedra acus, Pediastrum duplex, Scenedesmus quadricauda, Cyclotella meneghiniana, Synedra ulna, and Cyclotella kutzingiana, were significantly associated with base-rich conditions. An association diagram for all the species found in the lakes showed several groupings, mostly of species that prefer base-rich conditions. Few species confined to base-poor lakes were found to form associations. Apparent associations between oligotrophic species and species known to prefer eutrophic lakes can be explained by the fact that nutrients were depleted at the time of the survey. (Authors)

12501. Bams, R. A. (Fish. Res. Bd. Canada, Biological Sta., Nanaimo, B. C., Canada). 1970. EVALUATION OF A REVISED HATCHERY METHOD TESTED ON PINK AND CHUM SALMON FRY. J. Fish. Res. Bd. Canada, 27(8): 1429-1452.

An artificial incubation method employing filtered river water and a gravel substrate was compared with natural propagation in a test on pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon, at Hooknose Creek, King Island, B. C. At time of migration, about 70% of the hatchery pink fry were similar to the wild fry in stage of development; the remainder were immature. A similar but less pronounced difference occurred in the chum. Average rates of development were the same in the hatchery and the creek for each species. These two phenomena combined resulted in the hatchery fry of both species migrating, on the average,

from 1 to 2 weeks earlier than the wild fry. Growth during incubation was the same in hatchery and creek, i.e., no loss of potential size occurred in this hatchery environment. Survivals in the hatchery were higher than in the creek, but were less than expected on the basis of experiments carried out elsewhere. Hatchery pink fry showed a lower variability in mean lengths and weights than did creek fry, possibly in response to greater homogeneity of the incubational environment. Chum fry from the last part of the creek runs showed evidence of postemergent growth in fresh water. (Auth.)

12502. Parsons, John W. (Bur. of Comm. Fisheries, Great Lakes Fishery Lab., Ann Arbor, Michigan). 1970. WALLEYE FISHERY OF LAKE ERIE IN 1943-62 WITH EMPHASIS ON CONTRIBUTIONS OF THE 1942-61 YEAR-CLASSES. J. Fish. Res. Bd. Canada, 27(8): 1475-1489.

The commercial fishery for walleyes (Stizostedion vitreum vitreum) in Lake Erie virtually collapsed in the late 1950's. The extreme decline in production was attributed primarily to a succession of weak year-classes, caused by habitat deterioration (increased water temperatures, enrichment, and pollution) in western Lake Erie. Unusually high fishing intensity and high yields of walleyes in the mid-1950's contributed to the collapse. Annual lakewide production of walleyes dropped from a record high of 15 million lb. in 1956 to a record low of 717,000 lb. in 1962. Canadian catches exceeded those of the United States only during the high production years of 1956-58; U. S. fishermen took 71% of the total catch in 1915-62. On the basis of the numbers of fish of the various year-classes in the fall trapnet samples at Sandusky, Ohio, in 1943-62, all but one of the 1942-52 year-classes were above average strength, and all but one of the 1953-61 year-classes were below average. Fish of the 1953-61 year-classes grew much faster than those of the 1942-52 year-classes. The strong 1948 year-class was followed by a series of progressively weaker year-classes until 1958; year-class strengths remained low through 1962. (Auth.)

12503. MacDonald, J. Rod (Resource Development Branch, Dept. of Fisheries and Forestry of Canada, Halifax, Nova Scotia, Canada). 1970. AN OCCURRENCE OF MALE PREDOMINANCE AMONG REPEAT SPAWNING ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Canada, 27(8): 1491-1492.

An unusual case of male predominance among Atlantic salmon (Salmo salar) repeat spawners was observed in the Saint John River, N. B., in 1967. A sample of 947 Saint John River salmon (416 grilse and 531 older salmon) contained 91 repeat spawners, 50 (55%) of which were males. (Auth.)

12504. Vallentyne, J. R., W. E. Johnson, and A. J. Harris (Fish. Res. Bd. Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1970. A VISUAL DEMONSTRATION OF THE BENEFICIAL EFFECTS OF SEWAGE TREATMENT FOR PHOSPHATE REMOVAL ON PARTICULATE MATTER PRODUCTION IN WATERS OF LAKES ERIE AND ONTARIO. J. Fish. Res. Bd. Canada, 27(8): 1493-1496.

Filtered samples of raw sewage, biologically treated sewage, and sewage treated chemically for phosphate removal were added to unfiltered waters from lakes Erie and Ontario, and particulate residues (PR) on Millipore filters photographed after incubation in light for 10 and 30 days. PR levels in the sewage-enriched flasks were least in the case of sewage treated for removal of phosphates. Addition of phosphate to the phosphate-depleted effluent increased its PR generating ability to that of raw and biologically treated sewage. The removal of phosphates from sewage wastes thus appears to eliminate their fertilizing effect. (Authors)

12505. Gould, William R., and C. J. D. Brown (Coop. Fishery Unit, Montana State Univ., Bozeman, Montana). 1968. FISHES OF THE GENUS Semotilus (CYPRINIDAE) FROM MONTANA. Copeia, No. 3, pp. 628-629.

12506. Macek, Kenneth J., and Sidney Korn (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Lab., Columbia, Missouri). 1970. SIGNIFICANCE OF THE FOOD CHAIN IN DDT ACCUMULATION BY FISH. J. Fish. Res. Bd. Canada, 27(8): 1496-1498.

Brook trout accumulated approximately 10 times more of the available DDT from the food than directly from the water. Since, in aquatic environments, the concentration of DDT is usually much higher in the food chain than in the water, we suggest that the food chain is the major source of DDT for fish in natural waters. (Authors)

12507. Byrd, I. B. (Dept. of Conservation, Montgomery, Alabama). 1951. DEPTH DISTRIBUTION OF THE BLUEGILL, Lepomis macrochirus Rafinesque, IN FARM PONDS DURING SUMMER STRATIFICATION. Reprinted from Trans. Amer. Fish. Soc., Vol. 81, pp. 162-170.

Depth distribution of the bluegill, Lepomis macrochirus Rafinesque, in farm ponds was determined by the use of fish traps. Results indicated that during summer stratification bluegills were found in greatest numbers in shallow waters. They were unable to live for extended periods of 6 to 45 hours at water depths where the dissolved-oxygen concentration was 0.3 p.p.m. or less accompanied by a carbon-dioxide concentration of 4.4 p.p.m. or more. This condition was therefore considered to be the critical combined dissolved-oxygen and carbon-dioxide concentrations for bluegills and the depth that these concentrations usually occurred was designated as the critical depth. The critical depth was normally 5 feet in the 2-acre pond and 7 feet in the 22-acre pond during the period of summer stratification which was studied during the period from June 24 through September 12, 1949. With increases in surface areas of the ponds from 2 to 22 acres, the critical depths increased apparently as the result of deeper mixing of the waters due to increased wave action. The critical depth increased in all ponds following strong winds, heavy rainfalls, or cool periods. It decreased during periods of extended cloudiness or other conditions resulting in reduced photosynthetic activity in the deeper waters. (Auth.)

12508. Sherman, Kenneth (Bur. of Comm. Fisheries, Biol. Lab., W. Boothbay Harbor, Maine). 1970. SEASONAL AND AREAL DISTRIBUTION OF ZOOPLANKTON IN COASTAL WATERS OF THE GULF OF MAINE, 1967 AND 1968. U. S. Fish and Wildlife Service Special Scientific Report - Fisheries No. 594, 8 p.

The abundance, composition, and seasonal variations in the distribution of zooplankton are described. Thirteen taxa were among the more abundant zooplankters in the samples: 6 were holoplanktonic, and 7 were meroplanktonic. Copepods were the dominant zooplankters during all seasons in both years. Zooplankton volumes were highest in the western area (Cape Ann to Cape Elizabeth), intermediate in the central area (Cape Elizabeth to Mt. Desert Island), and lowest in the eastern sector (Mt. Desert Island to Machias Bay). The differences in zooplankton abundance among areas and between years were caused by variations in the timing of vernal warming and coastal differences in water column stability and circulation. (Auth.)

12509. Hubbs, Carl L., Arthur L. Kelly, and Conrad Limbaugh (Scripps Inst. of Oceanography, Univ. of California, San Diego, California). 1970. DIVERSITY IN FEEDING BY BRANDT'S CORMORANT NEAR SAN DIEGO. Calif. Fish and Game, 56(3): 156-165.

Brandt's cormorants feed on diverse assemblages of fish species, in a wide variety of habitats. They feed in dense kelp beds and in open water; in midwater; on the bottom, sometimes rather deep; and near the surface. Each day the birds move out en masse from fixed roosts. Mass flights to different feeding areas may be abruptly alternated on a time scale of a few days. This species, like some other cormorants, sometimes feeds singly or in small groups, often mixed with other bird species; but at times feeds in huge compact rafts of seemingly frantic birds, all of this species. These rafts move, apparently following schools of fish, by the repeated flight of groups of birds from the trailing edge to the very front

of the raft. Both large and small fish are consumed, most of which are of limited commercial significance. Cormorants are very accomplished underwater swimmers, making use of their feet only. (Authors)

12510. Gottschalk, John S. (Bur. of Sport Fisheries and Wildlife, Washington, D. C.). 1970. FISHERY MANAGEMENT IN SPANISH GALICIA. Progr. Fish Cult., 32(3): 123-129.

Spanish Galicia is famous for its salmon and trout fishing, particularly Atlantic salmon (Salmo salar), brown trout (S. trutta), and rainbow trout (S. gairdneri). The program for cotos (refuges) includes stocking, population surveys, and careful creel censuses, as well as refugios (fishing shelters), under the care of the guardas pesca (fish wardens). Especially impressive are the extent and competence of the management program and activities, as well as the effectiveness of management and production tools developed for specific conditions.

12511. Meyer, Frederick A. (Dept. of Fish and Game, Sacramento, California). 1970. DEVELOPMENT OF SOME LARVAL CENTRARCHIDS. Progr. Fish Cult., 32(3): 130-136.

Larval smallmouth bass (Micropterus dolomieui), largemouth bass (M. salmoides), redear sunfish (Lepomis microlophus), green sunfish (L. cyanellus), and bluegill (L. macrochirus) are described and illustrated. (Auth.)

12512. Tracy, Harry B. (Washington State Dept. of Fisheries, Olympia, Washington). 1970. DEVELOPMENT OF A FISH-SAMPLING FLUME. Progr. Fish Cult., 32(3): 137-141.

A plywood flume was developed to permit external examination of fish by means of mirrors, after which the fish were tagged with a shallow-water tagging gun. The flume was 120 x 72 x 25 inches in length, width, and depth, respectively, and was made from 3/4-inch marine plywood. The unit was fitted to a floating fish trap. (Auth.)

12513. Frogner, Karl J., and John R. Hendrickson (Dept. of Biol., Univ. of Chicago, Chicago, Illinois). 1970. A TECHNIQUE FOR COELOMIC ADMINISTRATION OF DRUGS TO FISH WITHOUT HANDLING. Progr. Fish Cult., 32(3): 142-146.

Repeated coelomic injections of drugs were given to experimental fish without causing the handling damage and undesirable stress which often interfere with experiments requiring multiple injections. A flexible, polyethylene catheter was implanted permanently through the body wall of the fish, and injections were made through the upper end of the catheter tube, with or without a detachable buoy for easy retrieval. Three different surgical approaches were described. Up to 12 injections per day for 3 days were sustained by the fish without obvious damage or inconvenience. In a time test, 1 fish with an unbuoyed catheter appeared to be in perfect condition with an undisturbed implant at the end of 1 month. (Authors)

12514. Brown, Bradford E. (Oklahoma Coop. Fishery Unit, Oklahoma State Univ., Stillwater, Oklahoma). 1970. COMPARISON OF MEASURES OF CATCH RATES OF SELECTIVE FISHERMEN IN AN OKLAHOMA SURVEY. Progr. Fish Cult., 32(3): 147-152.

Fisherman satisfaction was measured here in terms of the catch-per-hour fished. This was calculated by dividing the total catch of a particular species by the appropriate hours. Bases of effort included catch of a particular species divided by total effort, catch of fishermen accounting for 50% of the catch, catch of only successful fishermen capturing a particular species, and catch of fishermen capturing 1, 2, or 3 more fish.

12515. Johnson, Richard L. 1965. THE YIELD AND STANDING CROP OF FISH IN DAILEY LAKE, MONTANA. Proc. of the Montana Academy of Sciences 25, pp. 5-19.

12516. Stacy, Gus, III, R. Oneal Smitherman, and James W. Avault, Jr. (School of Forestry and Wildlife Management, Louisiana State Univ., Baton Rouge, La.). 1970. FOOD HABITS OF THE BOWFIN IN LACASSINE NATIONAL WILDLIFE REFUGE AND OTHER LOCATIONS IN SOUTHERN LOUISIANA. Progr. Fish Cult., 32(3): 153-157.

Stomach contents of 248 adult bowfin (Amia calva) were analyzed as to frequency of occurrence, weight, and volume. Major food items were grass shrimp, crayfish, fish, and insects. Only one gamefish, a bluegill (Lepomis macrochirus), was found. Location, size, sex, and season apparently caused no obvious differences in food habits. Stomach contents of ten fingerlings were analyzed as to frequency of occurrence and volume. Major food items were planktonic crustaceans, and small insect larvae and naiads. (Authors)

12517. Kilgen, Ronald H. (Auburn Univ. Agricultural Experiment Sta., Auburn, Alabama). 1970. UNINTENTIONAL STOCKING OF PONDS WITH FISH EGGS ATTACHED TO AQUATIC PLANTS. Progr. Fish Cult., 32(3): p. 157.

Three species of aquatic plants were collected, transported over 200 miles, and stocked (by weight) into ponds for weed control experiments. When ponds were drained 4 months later, four species of fish were found with the plants. Since these fish did not occur in any other ponds, and the water was filtered before entering the ponds, these fishes were probably introduced as eggs attached to the aquatic plants. (Auth.)

12518. Sills, Joe B. (Southeastern Fish Control Lab., Bur. of Sport Fisheries and Wildlife, Warm Springs, Georgia). 1970. A REVIEW OF HERBIVOROUS FISH FOR WEED CONTROL. Progr. Fish Cult., 32(3): 158-161.

Several species of imported herbivorous fishes control infestations of aquatic weeds. Tilapia sp. are effective only after overcrowded populations have been reached. The Israeli carp (Cyprinus carpio) controls a large variety of plants, but its disturbance of the pond bottom may be undesirable. The grass carp (Ctenopharyngodon idellus) consumes large volumes of vegetation, has shown no indication of natural reproduction, and does not disturb the pond bottom. (Auth.)

12519. Ryan, Patrick W., James W. Avault, Jr., and R. Oneal Smitherman (School of Forestry and Wildlife Management, Louisiana State Univ., Baton Rouge, Louisiana). 1970. FOOD HABITS AND SPAWNING OF THE SPOTTED BASS IN TCHEFUNCTE RIVER, SOUTHEASTERN LOUISIANA. Progr. Fish Cult., 32(3): 162-167.

Two hundred and forty adult spotted bass (Micropterus punctulatus) were collected from September 1966 through January 1968. Analyses of the 240 stomachs showed 214 (89.1%) containing food items: insects (50.5% occurrence), crustaceans (31.7% occurrence), and fish (19.1% occurrence). Crayfish were the most abundant food item in frequency and volume. Food preferences were not biased as to location of fish, sex, time of year, or size of fish. Analysis of stomachs from 6 fingerlings (length, 1.9 to 12.2 cm) revealed that the smallest bass ate mostly crustaceans, whereas larger bass ate larger insects, fish, and grass shrimp. Spotted bass in Tchefuncte River spawned in May and June when the water temperature ranged between 68°F. and 70°F. (Authors)

12520. McDonald, Robert, and Robert Thomas (Nebraska Game and Parks Comm., Hastings, Nebraska). 1970. A PRELIMINARY EVALUATION OF POLYELECTROLYTES AS POSSIBLE WATER CLARIFICATION AIDS FOR TREATMENT OF TURBID FISH PONDS. Progr. Fish Cult., 32(3): 174-177.

Laboratory jar tests revealed that turbidity reduction varied with the amount of turbidity plus type and concentration of polyelectrolyte. A high of 97% turbidity reduction was noted. The field test conducted gave satisfactory results. Turbidity was reduced in a small farm pond from 550 to 30 J.T.U. (Authors)

12521. Piper, Robert G. (Fish Cultural Development Center, Bur. of Sport Fisheries and Wildlife, Bozeman, Montana). 1970. A SLIDE-RULE FEEDING GUIDE. Progr. Fish Cult., 32(3): 168-169.

A slide-rule method for calculating trout feeding levels can be used with any species of fish having a logarithmic straight-line relationship between rate of feeding and length of fish. (Auth.)

12522. Hale, John G. (Fed. Wat. Poll. Contr. Admn., Nat. Wat. Quality Lab., Duluth, Minnesota). 1970. WHITE SUCKER SPAWNING AND CULTURE OF THE YOUNG IN THE LABORATORY. Progr. Fish Cult., 32(3): p. 169.

Sexually mature white suckers (Catostomus commersoni) collected from a lake inlet were spawned and reared in the laboratory. The inlet water temperature (16°C.) was maintained in the laboratory (± 1°C.), and coarse gravel (diameter, 2.5 to 7.6 cm) covered the bottom of the "upstream" half of the 2.1- x 0.6- x 0.4-m tank. Eggs were found in about 40 hours. After 7 days at 16°C., the hatch was estimated to be 90% complete. Live brine shrimp and commercial trout starter were offered to the fry. About 1 month after hatching, brine shrimp was discontinued. When 93 days old, the fish had almost doubled their size, ranging from 20.0 to 34.0 mm in length. (Auth.)

12523. Post, George (Dept. of Fishery and Wildlife Biol., Colorado State Univ., Fort Collins, Colorado). 1970. DETERMINATION OF INERT GASES IN WATER. Progr. Fish Cult., 32(3): 170-173.

A method for measuring inert gases involves the release of all dissolved gases from a known quantity of water by heating the water. The gases are trapped in a graduated syringe. Total volume of released gases is determined. Carbon dioxide and oxygen are absorbed. The volume of inert gases (nitrogen, krypton, xenon, neon, etc.) is estimated by subtraction. A method for determining percent saturation of inert gases (as nitrogen) at various water temperatures and atmospheric pressures is given. Precision of the method falls between 3 and 7% of known values. (Auth.)

12524. Clifford, Thomas J., and Richard L. Applegate (So. Dakota State Univ., Brookings, South Dakota). 1970. LYMPHOCYSTIS DISEASE OF TAGGED AND UNTAGGED WALLEYES IN A SOUTH DAKOTA LAKE. Progr. Fish Cult., 32(3): p. 177.

Adult walleyes (Stizostedion vitreum vitreum) tagged in the spring of 1967 with double barb spaghetti tags at Lake Poinsett, South Dakota, had a lymphocystis infection rate of 34.5% in the spring of 1968. Walleye not previously tagged had an infection rate of 2.2%. (Authors)

12525. Plosila, Daniel S., and Bruce D. White (Fish Res. Unit, N. Y. State Conservation Dept., Ray Brook, New York). 1970. A SWINGING VERTICAL SCREEN FOR FISH BARRIER DAMS. Progr. Fish Cult., 32(3): 178-179.

Swinging vertical screens used with barrier panels effectively prevented fish from ascending spillways at 2 barrier dams, while remaining free to swing open if subjected to unusually high flows. (Authors)

12526. Short, Zella, and Paul R. Olson (Coll. of Fisheries, Univ. of Washington, Seattle, Washington). 1970. OYSTER SHELLS AND FOAM FORMATION USED TO IMPROVE QUALITY OF WATER RECIRCULATED IN A FISH HATCHERY INCUBATOR. Progr. Fish Cult., 32(3): 180-182.

The osmotic environment as measured by calcium content, alkalinity, and specific conductance was improved by recirculating water in a fish hatchery unit over oyster shells. Ammonium-nitrogen and total nitrogen remained negligible in the water but were accumulated in the foam, which formed at the periods of hatching. (Authors)

12527. Kreis, R. Douglas, and Robert L. Smith (Fed. Wat. Poll. Contr. Admn., Water Research Center, Ada, Oklahoma). 1970. A METHOD OF SUSPENDING MULTIPLE "BASKET SAMPLERS" IN RESERVOIRS. Progr. Fish Cult., 32(3): 182-183.

A triangular frame placed around a stationary buoy was used to suspend limestone-filled artificial substrate (basket) samplers at 3 depths. Two samplers were suspended at each depth to collect replicate macroinvertebrate samples. The apparatus is stable in rough water and, with the exception of the stationary buoy, can be installed, serviced, and removed by one person. (Authors)

12528. Greene, George N. (Fish. Div. Agricultural Experiment Sta., Auburn Univ., Auburn, Alabama). 1968. EFFECT OF DIFFERENT NITROGEN SOURCES AND SOIL ON FISH PRODUCTION AND WATER CHEMISTRY IN FERTILIZED PLASTIC POOLS. Reprint from Proc. of Twenty-second Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners held at Baltimore, Maryland October 21-23, 1968, pp. 264-267.

Fertilization with phosphate alone increased fish production an average of five times above that of unfertilized pools. The additional use of inorganic nitrogen, either ammonia or nitrate, caused a small but insignificant increase in production. The use of an organic nitrogen source resulted in a significant increase in production to 9.3 times that of unfertilized pools. This was apparently a result of its utilization as food by the fish and organisms lower in the food chain. The presence of Cecil soil had no effect on fish production or upon ammonia or organic nitrogen. However, the presence of soil decreased the total and dissolved organic carbon in the water. Three of the four water quality measures, organic nitrogen, ammonia nitrogen, and total organic carbon, were higher in fertilized pools than in unfertilized pools. Among fertilizer treatments the nitrate fertilizer was always significantly higher than phosphate fertilizer. The other two fertilizer treatments were intermediate and usually were not significantly different from either extreme. The fourth water quality measure, dissolved organic carbon, showed no significant differences between fertilizer treatments, or between fertilized and unfertilized treatments. (Auth. summ. and conclusions)

12529. Enomoto, Yoshimasa. 1969. ON SOME NOTES ABOUT THE FLUCTUATIONS OF THE BLOOD LEUCOCYTE NUMBERS OF THE CULTURED FISH. Bull. Tokai Fish. Res. Lab. Tokyo, No. 57, pp. 137-177. (In Japanese with English abstract).

Attempt is made to compile a priori data about the numbers of blood leucocytes in such important cultured fish as the yellow tail, Seriola quinqueradiata, the rainbow trout, Salmo irideus, the eel, Anguilla japonica, and the "ayu", Plecoglossus altivelis, with the aim of utilizing the results for fish disease diagnosis, for judgement of the state of health of fish, or for detection of diseases at early stages. (From auth.)

12530. Suzuki, Akimi. 1968. STUDIES ON THE BLOOD TYPES OF FISH WITH RADIOACTIVE ANTIBODIES - I. PREPARATION OF ^{131}I-MARKED ANTIBODIES AND DRIED BLOOD SAMPLES. Bull. Tokai Fish. Res. Lab. Tokyo, No. 56, pp. 117-124. (In Japanese with English abstract).

Attempt was made to develop a blood typing method by using dried samples of fish blood and radioactive antibodies. The studies involved the erythrocyte antigens of tunas, skipjack and carp, and the use of radioactive antibodies. Data are presented which show that the results obtained from radioactivity analysis agree very well with those from intact erythrocytes. (From auth.)

12531. McDowall, R. M. (Fish. Res. Div., Marine Dept., Wellington, New Zealand). 1969. LUNAR RHYTHMS IN AQUATIC ANIMALS. A GENERAL REVIEW. Reprint from Tuatara, 17(3): 133-144; Fisheries Research Publication No. 141.

12532. Yamamura, Yarokuro. 1970. STUDIES ON THE "PHOTOTAXIS" OF THE SAURY. (2). DISTRIBUTION OF VITAMIN A OF THE EYE AND THE OTHER ORGANS IN MATURE AND IMMATURE FISHES. Bull. Tohoku Fish. Res. Lab. No. 30, pp. 113-121. (In Japanese with English abstract).

Saury fishing is conducted with lamps, taking advantage of the phototaxis of the juvenile saury. Mature sauries do not gather around light. To explain this, sauries with ripe gonads were analyzed for vitamin A content of the eye, liver and gonad. The vitamin A of the eye was not deficient even in the ripest saury. The relationships of the vitamin A content of the eye to the other organs was studied statistically. There are close correlations between the vitamin A of the liver and total vitamin A; also, between the vitamin A content of the egg and gonad weight. There is moderate correlation between the vitamin A content of the egg and the liver. There are no correlations between the vitamin A content of the egg and the gonad; the liver and body-length; the liver and gonad weight; the egg and liver; the liver and fattiness of the saury, respectively. Although the mature saury showed no vitamin A deficiency in the eye, one must consider the fact of isomerization of vitamin A; i.e. the cisform-transform translation in the visual cycles. It is supposed from the additional test of maleic anhydride that there is difference in the content of cis- and trans-form vitamin A in the eye and the visceral organs. The question of phototactic difference between the immature and mature saury is yet to be answered. (From auth.)

12533. Tsujita, Tokimi. 1970. SOME PROBLEMS IN MARINE ECOLOGY RELATED TO FISHERY RESEARCHES. Bull. Tohoku Fish. Res. Lab., No. 30, pp. 29-42. (In Japanese with English abstract).

It is proposed that methods of behavioral science should be introduced to studies of fish responses to environmental changes and to behavioral studies. Long-term variations of environmental factors of such cosmic periodicities as the major currents and diel rhythms in light and water temperature due to solar-day and lunar-day periodicities are uncontrollable information for living organisms. In these periodicities of the environmental factors, circadian rhythms are entrained to those organisms and must be considered in study of the environment, and the long-term variations are used for the periodic migratory movement of the fish. Some examples in Scomber japonicus, Trachurus japonicus and Sardinops melanosticta in the waters around Japan are presented. For environmental study of a production system having trophic levels such as forage organisms and fish, the environment should be measured by a grid method. The grid method for measuring the environment may also be applied to studies of its influence upon migratory movement and fluctuations of fish resources. (From auth.)

12534. Kato, Mamoru. 1970. REVIEWS ON SOME PROBLEMS OF AGE DETERMINATION BY THE SCALE OF THE MASU SALMON, Oncorhynchus masou (Brevoort). Bull. Japan Sea Fish. Res. Lab., No. 22, pp. 15-29. (In Japanese with English abstract).

Scale samples of 470 masu salmon, Oncorhynchus masou (Brevoort), collected from the offshore regions of the Japan Sea during the spring seasons of 1965 and 1966 were examined. Some problems on the age determination of the fish are discussed. Through freshwater- and marine life, the relationships between scale size (R) and fork length (L) is expressed by the quadric equation, $L = 42.8\,R^2 + 96.2\,R + 48.3$, in mm. In most individuals, it is estimated that the marine annulus on the scales was formed in January or February, and that the fork length at the annulus formation ranged from 28 to 35 cm. Although the marine annulus has not been found in some individuals, there is no evidence that the annulus is about to form. They seem to have passed the last winter under different food supply or other environmental conditions. According to age determination criteria given by previous researchers, the age composition of the present material was 80-90% 3_2 age group and 10-20% 4_3 age group. However, the calculated fork length at the formation of each "mark" on the central part of the scales and the number of circuli between the focus and each "mark" disagreed with the known information obtained from juveniles. Therefore, it is necessary to reexamine the criteria on age determination when the fish lives in fresh and coastal waters. (Auth.)

12535. Fukataki, Hiroshi. 1970. FURTHER NOTES ON MIGRATION OF THE MASU SALMON, Oncorhynchus masou (Brevoort), IN THE JAPAN SEA AS DETERMINED BY TAGGING. Bull. Japan Sea Fish. Res. Lab., No. 22, pp. 1-14. (In English).

From tagging experiments carried out during the four-year period, 1965-68, it may be concluded that the natal streams of the masu salmon wintering in the southern part of the Japan Sea extend over the Pacific side of southern Hokkaido, the Japan Sea side or the Okhotsk Sea side of northern Hokkaido, Sakhalin, northern Primorskaia and southern Primorskaia as well as the Japan Sea side of northern Honshu and southern Hokkaido. At the same time, it is also suggested that these stocks, except the southern Primorskaia one, intermingle partially with each other off northern Honshu. (From auth. conclusions).

12536. Fowler, James A. (State Univ. of New York at Stony Brook, Stony Brook, New York). 1970. CONTROL OF VERTEBRAL NUMBER IN TELEOSTS - AN EMBRYOLOGICAL PROBLEM. Quart. Rev. Biol., 45(2): 148-167.

It has long been known that meristic characters, and especially the number of vertebrae, in many fishes are affected by environmental factors such as temperature, salinity, oxygen concentration, and light during early development. The temperature response curve of vertebrae number for offspring from a single mating is often U-shaped, but may be inversely linear or some other shape. Less is known about response to other variables, but there is generally a clear trend within the tolerance range. The genotype of a fish significantly affects the response curve of vertebral number to environmental factors. A few studies have shown that tetrapod meristic characters are also sensitive to temperature and light. Earlier review and recent experimental papers are cited and analyzed to show that these phenomena can now be investigated experimentally. Metabolic rate has been correlated with vertebral number and the possible implications of this are discussed. Theories accounting for the formation of somites are examined. The customary methods of measuring development are regarded as inexact and unsuitable for explanation of the phenomena discussed here. Two interesting evolutionary implications are discussed: the absence of genetic assimilation of vertebral number, and the apparent absence of selection for a single specific vertebral number in each population. (Auth.)

12537. Arnott, H. J., N. J. Maciolek, and J. A. C. Nicol (Univ. of Texas Cell Res. Inst., Austin, Texas). 1970. RETINAL TAPETUM LUCIDUM: A NOVEL REFLECTING SYSTEM IN THE EYE OF TELEOSTS. Science, 169(3944): 478-480.

A new type of tapetum lucidum has been found in eyes of bony fishes (teleosts). It is retinal, lying in the processes of the pigment epithelial cells; it has a white appearance and reflects light diffusely. The cell processes are loaded with highly refractile lipid particles; as examined by electron microscopy these are about 400 nanometers in diameter, spherical, and homogeneous. This tapetum lucidum has been found in seven families of teleost fishes occurring in inshore waters and rivers of South Texas, all of which have high turbidity; the correlation indicates a role in dim-light vision. (Authors)

12538. Schwartz, Erich (Zoophysiolog. Inst. der Univ., Tubingen, Germany). 1970. LATERAL LINE SENSE ORGANS OF SURFACE FEEDING FISHES. Zeitschrift für Morphologie der Tiere, 67(1): 40-57.

The arrangement of lateral line sense organs in 4 families of nonrelated surface feeding fishes is described. Although lateral line sense organs in these fishes show great variability they are all sensitive to surface waves. Morphological differences are emphasized and discussed functionally. (Auth.)

12539. Sundeen, Donald Roy. 1969. ABUNDANCE AND MOVEMENT OF YOUNG TROUT IN A PORTION OF THE MADISON RIVER, MONTANA. Reprint from Proc. of the Montana Academy of Sciences No. 29, pp. 40-50.

12540. Merriman, Daniel. 1970. THE CALEFACTION OF A RIVER. Scientific American, 222(5): 42-52.

Calefaction means warming, and the industrial warming of rivers and other waters is a cause of concern. A study of the warming of the lower Connecticut River, however, reveals no drastic effects. (Auth.)

12541. Beckert, Heino, and Ray Allison (Agricultural Experiment Sta., Auburn Univ., Auburn, Alabama). 1964. SOME HOST RESPONSES OF WHITE CATFISH TO Ichthyophthirius multifiliis, Fouquet. Reprint from Proc. of the Eighteenth Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, October 18-21, 1964, 3 p.

Fingerlings of white catfish, Ictalurus catus, were infected with 1, 10, 50, 100, 500, and 1,000 trophozoites of I. multifiliis per fish. There were no mortalities at rates of 1 and 10 trophozoites per fish. Infection rates of 50 and 100 trophozoites per fish resulted in a 33.3 percent mortality in each case. Infection rates of 500 and 1000 trophozoites per fish resulted in a 100 percent mortality. Immunized fish were challenged at rates of 10, 30, 50, and 100 trophozoites per fish. At challenge rates of 10 and 50 trophozoites per fish, no mortalities occurred. Rates of 30 and 100 trophozoites per fish resulted in a 10.0 percent and 17 percent mortality, respectively. Fish surviving an infection at 54°F showed no immune response when challenged at 54°F but did show an immunity when challenged at 78°F. (Authors summ.)

12542. Hopkins, C. L. (Fish. Res. Div., Marine Dept., Wellington, New Zealand). 1970. SOME ASPECTS OF THE BIONOMICS OF FISH IN A BROWN TROUT NURSERY STREAM. Fish. Res. Bull. No. 4, 38 p.

The population density, growth, and food have been described for the members of a mixed population of juvenile brown trout, bullies, and eels. The data presented have been used to examine the ecological and competitive food relations of these species. The food of all species of fish was the stream benthos, and most of the animals eaten belonged to the Ephemeroptera and Trichoptera. The invertebrate fauna was of "average richness" on the grading used for North American streams and in both density and biomass surpassed that of the Horokiwi, which has been considered to be similar to many New Zealand streams. A consideration of the daily food requirements of the fish and the availability of food led to the conclusion that under normal conditions food was not a limiting factor among the adults and large juveniles. There seemed little interspecific competition for food, for living space, or for spawning sites. It was considered that predation by larger fish on smaller was insignificant. Yet 90 percent of young bullies and trout were lost during the first few months of life; so intense intraspecific competition among very young fish was postulated. During the period of highest mortality these young fish were present in large numbers, shared the same food requirements, and apparently ate a limited variety of food items. Under these conditions the availability of food and of living space were probably the principal factors governing their survival. There appeared to be several mechanisms operating among the young fish to reduce the likelihood of a general food shortage. Among the trout fry, territorial behaviour ensured dispersal of fish and reduced feeding pressure. Among bully fry, which showed no obvious territorialism, there was evidence of migration by some members down stream from the breeding area; moreover the protracted breeding season gave rise to a year class of large size range which might be expected to eat a wide range of food. (Auth. summ.)

12543. Rogers, Wilmer A. (Agricultural Experiment Sta., Fish. Lab., Auburn Univ., Auburn, Alabama). 1969. TWO NEW SPECIES OF Pseudomurraytrema FROM GILLS OF ALABAMA CATOSTOMID FISHES. Reprint from The Journal of Parasitology, 55(2): 321-323.

Pseudomurraytrema coosense sp. n. and P. fluviatilis sp. n. are described from the gills of the black redhorse, Moxostoma duquesnii (Le Sueur) and the river redhorse, Moxostoma carinatum (Cope), respectively. (Auth.)

12544. Iizuka, Keiki, and Katsumi Kotaki 1969. SOME REARING EXPERIMENTS FOR THE IMPROVEMENT OF TAGGING TECHNIQUES OF THE JUVENILE MACKERELS. Bull. Tohoku Fish. Res. Lab., No. 29, pp. 19-36. (In Japanese with English abstract).

During the summers of 1966 to 1968, three rearing experiments with juvenile mackerel were carried out to find the most effective tagging techniques, to investigate better methods of attachment, to compare the mortality rate due to the different types of tag, and to estimate tag loss by shedding from the fish, etc. The smaller fish in body length had a higher mortality rate than the larger, and the slender ones showed a high mortality rate. The dart-type tag could be attached to the fish easier than the others; however, the mortality and shedding of the tag was most remarkable. The most suitable was the Atkins type tag, and attachment to the dorsal area (rear of first dorsal fin) is recommended. Mortality of fish with a tag attached dorsally usually appeared after five days of attachment. Perhaps this is due directly to effects of the tagging operation. Shedding of the dorsal-Atkins tag was caused by tearing of the flesh around the tag; looseness of the connecting thread was rare. Behavior of tagged- and control fish was similar but injured fish always remained solitary. For tagging in nature, the stoutest fish should be selected as carriers. Anesthetization with 0.01 percent MS 222 solution was tried on juvenile mackerel. Individuals anesthetized within six minutes recovered soon after transfer into sea water, with no behavioral after-effects. (Authors)

12545. Chernenko, Ye. V. (Kamchatka Dept., Pacific Res. Inst. for Sea Fisheries and Oceanog. — TINRO Petropavlovsk; Lab. of Genetics and Selection, All-Union Res. Inst. for Pond Fisheries — VNIIPRKh, Rybnoe, Moscow Province, USSR). 1969. EVOLUTION AND CYTOTAXONOMY OF THE FAMILY SALMONIDAE. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 781-788. (Translated and produced by Scripta Technica, Inc.).

A graphic method is proposed for the comparison of karyotypes, by which it is possible to estimate the degree of karyological similarity or difference of species. It is revealed on the basis of graphic comparison that it is possible to specify the types of chromosome mutations for each genus which have led to cytologically detectable differences in the structure of the karyotypes. It is also shown that the magnitude of differences in the karyotypes of species assumed to be more primitive are greater than between species assumed to be more recently evolved. The mutual disposition of the curves on the graphs supports the hypothesis that salmon of the genus Oncorhynchus originated from the Pacific Ocean Salmo.

12546. Gulidov, M. V. (A. N. Severtsov Inst. of Evol. Morph. and An. Ecol., USSR Acad. of Sci. (IEMEZh), Moscow, USSR). 1969. EMBRYONIC DEVELOPMENT OF THE PIKE (Esox lucius L.) WHEN INCUBATED UNDER DIFFERENT OXYGEN CONDITIONS. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 841-851. (Translated and produced by Scripta Technica, Inc.).

An account is given of experimental data on the effect of oxygen conditions on the development of the pike. Upper and lower threshold concentrations of oxygen are established. There is shown to be a pattern in the variation in mortality during incubation of the eggs and the number of individuals hatched when oxygen content is varied in the range between the upper and lower threshold concentration, and qualitative features of the development of the embryos are also established.

12547. Bevan, Donald E. (College of Fisheries, Univ. of Washington, Seattle, Washington). 1969. THE USE OF COMPUTERS IN THE COLLEGE OF FISHERIES, UNIVERSITY OF WASHINGTON. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 810-820. (Translated and produced by Scripta Technica, Inc.).

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12548. Krogius, F. V. (Kamchatka Dept., Pacif. Res. Inst. for Sea Fish. and Oceanography — KOTINRO, Petropavlovsk). 1969. PRODUCTION OF YOUNG SOCKEYE SALMON [Oncorhynchus nerka (Walb.)] IN LAKE DAL'NEYE. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 852-865. (Translated and produced by Scripta Technica, Inc.).

An account is given of the procedure used to determine the abundance of sockeye fingerlings entering Lake Dal'neye over a period of 27 years and the abundance of young sockeye living in the lake, and also the growth of the sockeye. Mean monthly biomass and the production and mortality of young of all ages have been calculated on the basis of the data obtained and food consumption has been calculated on the basis of the data of Ye. M. Krokhin concerning the food rations of the young.

12549. Shcherbina, M. A. (All-Union Res. Inst. for Pond Fisheries, VNIIPRKh, USSR). 1969. THE AVAILABILITY TO POND FISHES OF THE AMINO ACIDS OF ARTIFICIAL FOODS. COMMUNICATION I. AVAILABILITY TO TWO-YEAR-OLD CARP OF THE AMINO ACIDS OF BARLEY, PEAS, GROUNDNUTS AND A FEEDING MIXTURE. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 876-879. (Translated and produced by Scripta Technica, Inc.).

Data on the availability to two-year-old carp of 15 amino acids of the foods investigated are given and their protein nutritional value is discussed on that basis.

12550. Akulin, V. N. (I. M. Sechenov Inst. of Evol. Physiol. and Biochem., USSR Acad. of Sci., Leningrad; Kamchatka Dept., Pacif. Res. Inst. for Sea Fisheries and Oceanog. — KOTINRO, Petropavlovsk, USSR). 1969. FATTY ACID COMPOSITION OF THE PHOSPHOLIPIDS OF THE MUSCLES AND LIVER OF THE SOCKEYE SALMON [Oncorhynchus nerka (Walb.)] AND OF THE ZOOPLANKTON FROM LAKE DAL'NEYE. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 880-887. (Translated and produced by Scripta Technica, Inc.).

A study has been made of the phospholipid composition and the composition of the fatty acids of the lecithin, phosphatidylethanolamine, phosphatidylserine, and polyglycerophosphatides of sockeye muscles and liver at different stages in the marine and freshwater periods of life. The investigation has shown that the fatty acid composition of the phospholipids reveals differences which reflect the conditions of existence of a fish and are characteristic of what are referred to as marine and freshwater lipids. The preparation of the sockeye for spawning is accompanied by alterations in the fatty acid composition of the phospholipids and in the phospholipid composition of the tissues investigated. It has been established that there is great similarity in fatty acid composition between the lipids of the sockeye in the freshwater period of life and of the fodder zooplankton from Lake Dal'neye.

12551. Ochinskaya, Ye. I. (Lab. of Behav. Physiol. and Genet., Biol. and Soil Sci. Faculty, Moscow State Univ., USSR). 1969. A STUDY OF EXTRAPOLATION OF THE DIRECTION OF MOVEMENT OF THE FOOD STIMULUS IN BENTHOPHAGES. Problems of Ichthyology (Voprosy ikhtiologii). American Fisheries Society, 9(6): 888-892. (Translated and produced by Scripta Technica, Inc.).

An account is given of the results of experimental studies of extrapolation of the direction of movement of a food stimulus in three species of benthophages: goldfishes, crucian carp and carp.

12552. Mironov, O. G. (Inst. of the Biol. of the Southern Seas, Ukr. Acad. of Sci., Sevastopol, USSR). 1969. THE DEVELOPMENT OF SOME BLACK SEA FISHES IN SEA WATER POLLUTED BY PETROLEUM PRODUCTS. Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(6): 919-922. (Translated and produced by Scripta Technica, Inc.).

The harmful effect of petroleum pollution is exerted at all the concentrations of petroleum products tested (0.1-0.001 ml/liter), as was expressed in the loss of developing eggs of the Black Sea anchovy, the Black Sea scorpion-fish and the sea-parrot.

12553. Petrova, Ye. G. (All-Union Res. Inst. for Mar. Fish. and Oceanog. (VNIRO), Moscow, USSR). 1969. SOME GROWTH CHARACTERISTICS OF THE AZOV BREAM (Abramis brama). Problems of Ichthyology (Voprosy ikhtiologii), American Fisheries Society, 9(5): 730-732. (Translated and produced by Scripta Technica, Inc.).

Data obtained on the compensational growth of the Azov bream show that individual deviations observed in the growth rate of the bream in the first year of life did not manifest themselves in subsequent years, and that the older the fish the smaller was the influence of the body length as a yearling on its growth.

12554. Greenfield, David W., Stephen T. Ross, and Gary D. Deckert (Dept. of Biology, California State College, Fullerton, California). 1970. SOME ASPECTS OF THE LIFE HISTORY OF THE SANTA ANA SUCKER, Catostomus (Pantosteus) santaanae (Snyder). Calif. Fish and Game, 56(3): 166-179.

The life history of Catostomus santaanae, a small fluviatile species of the subgenus Pantosteus occurring in the Santa Clara River, California, was studied from April 1968 to August 1969. Peak spawning activity occurred during May and June with a few individuals spawning as early as March and at least as late as July. Fecundity in six individuals ranged from 4,423 to 16,151. The fertilized ova are demersal and adhesive. C. santaanae matures at 1+ with only a few individuals reaching the 3+ age-group. A vertebral deformity was observed in up to 3.47% of the individuals in the monthly samples. However, this apparently did not result in a selective disadvantage in terms of survival. The species is well adapted for survival in streams subject to heavy flooding, both in its ability to withstand rapid currents and also in its ability to repopulate rapidly following the loss of a large percent of the population. (Authors)

12555. Grigg, Richard W. (Univ. of Calif., San Diego, California). 1970. SOME ECOLOGICAL EFFECTS OF DISCHARGED WASTES ON MARINE LIFE. Calif. Fish and Game, 56(3): 145-155.

The number of macroscopic species present at five stations ranging in depths from 45 to 65 ft off the Palos Verdes Peninsula, near San Pedro, California, was negatively correlated to the amount of fine grain organic-laden sand present in the sediment. Organic rich sediments were thickest at stations near the outfall. Accumulation of this material at these depths appears to have modified or covered substrates otherwise suitable for the settlement of many epibenthic species. (Auth.)

12556. Nishimoto, Kiro (U. S. Bur. of Comm. Fisheries, Auke Bay, Alaska). 1970. WESTERN RANGE EXTENSION OF THE ROSETHORN ROCKFISH Sebastes helvomaculatus (Ayres). Calif. Fish and Game, 56(3): 204-205.

The capture of a female rosethorn rockfish off Sitkinak Island, Alaska, extended the known range about 365 nautical miles to the southwestward. (Auth.)

12557. Edwards, George D. (U. S. Army Medical Res. Lab., Edgewood Arsenal, Maryland). 1970. OBSERVATION OF MATING BEHAVIOR OF THE STRIPED PERCH AND NOTES ON POSSIBLE REPRODUCTIVE ACTIVITY OF THE RAINBOW PERCH. Calif. Fish and Game, 56(3): 205-206.

Behavior of Embiotoca lateralis and Hypsurus caryi is described as observed at Monterey Bay, California. (Auth.)

12558. Swingle, H. S. (Dept. of Zoology-Entomology, Auburn Univ. Auburn, Alabama). 1965. FERTILIZING FARM FISH PONDS. Reprint from: Agricultural Exp. Sta. of Auburn Univ. Highlights of Agric. Research 12(1): p. 11.

It was originally recommended that fertilizer be applied by broadcasting over shallower water areas, or by pouring it in a line 15 to 20 ft. from the shoreline around shallower parts of the pond. Later it was found that less fertilizer was required and better results were obtained if fertilizer was placed on a platform about 1 ft. under water. Wind and waves were effective in distributing nutrients throughout the pond as they dissolved from fertilizer on the platform. Circulation

of nutrients in top waters reduced the amount of fertilizer required annually by 20% to 40%. After a few years of fertilization, a "complete fertilizer" is no longer necessary. Nitrogen and potassium can be omitted. However, continued use of phosphate is necessary. (From auth.)

12559. Ishikura, Shunji, and Chieko Shibuya (Tokyo Science Univ., Japan). 1968. ANALYSIS OF MERCURY OF FISHES AND SOILS OF AGANO RIVER. (In Japanese). Eisei Kagaku, 14(4): 228-230; Selected Water Resources Abstracts, 3(17): p. 30.

The analysis of mercury was carried out to clear the cause of occurrence of poisoned patients caused by organic mercury around the Agano River. The mercury content was estimated photometrically from the mercury dithizonate which was isolated from dithizon extract of oxidative degradation product of samples such as soils, fishes and waters. It was found that the soils obtained near the draining exit of Shyowa Denko and Nippon Gas Kagaku contained high amounts of mercury, whereas the mercury was not detected clearly in any waters. Some fishes were also found to keep the high concentration of the total mercury and organic mercury. -- Sjolseth.

12560. Albrecht, Marie-Luise 1969. SPLEEN AND KIDNEY MASS - A MEASURE OF THE PHYSIOLOGICAL ACTIVITY OF THE CARP (Cyprinus carpio L.). In German. Zeitscrift fur Fischerei, NF Band 17, Heft 1-4, pp. 79-100; Selected Water Resources Abstracts, 3(17): p. 31.

Studies on the changes in size of spleen and kidney in carp under different conditions of life have shown that the shape of these organs, especially that of the spleen, may change considerably. It was observed that at relative inactivity (narcotization, low water temperatures) spleen and kidney of carp are full of blood. When in summer the activity of muscles is raised these organs deliver blood to the circulation system. When exposed for a long time to higher temperatures (30° C) spleen ischemia and kidney atrophy become especially evident. Stresses as oxygen deficit, catching, holding and transporting in tanks also affect the blood filling rate of organs and lead to blood delivery. These processes are controlled by nerves and hormones. Outbreaks of acute infectious dropsy in carp leads to swelling of spleen and kidney caused by failure of the osmo-regulating mechanism and so the water content of organs raises. Carp react very sensitively to every physiological stimulus, this is shown i. a. by the blood content of spleen and kidney. The state of these organs, especially that of the spleen may serve as indicator for the physiological condition both of individual fish and of the entire stock. -- Sjolseth.

12561. Matsuda, Robert I., Gary W. Issac, and Raymond D. Dalseg (Seattle Metropolitan Municipality, Seattle, Washington). 1968. FISHES OF THE GREEN-DUWAMISH RIVER. Water Quality Series No. 4, December 20, 1968, 38 p.; Selected Water Resources Abstracts, 3(17): p. 31, 1970.

This is a summary of a three year (1964-1966) study of the effects of the effluents from the Renton Waste water Treatment Plant on the fishlife of the Green-Duwamish River. The study included only the four most abundant of the 30 varieties of fish found in the river -- Shiner Perch, Staghorn Sculpin, Starry Flounder, and the Chinook Salmon. Since no historical study of the fishes of the river could be found, this documentation is an original report. The seasonal and yearly population fluctuations of the selected species were studied. The Shiner Perch and Staghorn Sculpin population increased. The Starry Flounder population remained constant. The number of Chinook Salmon declined at one station and was variable at the other. It was concluded that the overall effect of the Renton Water Treatment Plant on the Green-Duwamish River is not detrimental to fish and desirable aquatic organisms and that the treatment plant may have contributed to the increase in fish population of some species. As the human population increases and industries expand in the Metro Service area, requiring expansion of the Renton Treatment Plant to 10 times its present effluent discharge rate, it will be necessary to continue these studies to predict the effects of increased discharges on fish populations. -- Poertner.

12562. Reinert, Robert E. (Bur. of Comm. Fisheries, Ann Arbor, Michigan). 1970. PESTICIDE CONCENTRATIONS IN GREAT LAKES FISH. Contrib. No. 371 of Great Lakes Fishery Lab.; Pesticides Monitoring Journal, 3(4): 233-240; Selected Water Resources Abstracts, 3(17): p. 32.

Reports on a 4 year study by Ann Arbor Great Lakes Fishery Laboratory of the Bureau of Commercial Fisheries on insecticide levels in fish from the Great Lakes. The two insecticides found in all Great Lakes fish have been DDT (DDT, DDD, DDE) and dieldrin. Fish from Lake Michigan contain from 2 to 7 times as much of these insecticides as those from the other Great Lakes. Insecticide levels calculated on a whole-fish basis show a marked difference from species to species. Within a species there is also an increase in DDT and dieldrin levels with an increase in size. If these insecticide levels are, however, calculated as ppm of insecticide in the extractable fish oil, the differences in concentration between species and the differences between size groups becomes considerably less. Laboratory experiments indicate that fish can build up concentrations of DDT and dieldrin at the parts-per-million level from parts-per-trillion concentrations in the water. -- Sjolseth.

12563. Pickering, Quentin H., and Thomas O. Thatcher (Fed. Water Poll. Contr. Admn., Newtown Fish Toxicology Lab., Cincinnati, Ohio). 1970. THE CHRONIC TOXICITY OF LINEAR ALKYLATE SULFONATE (LAS) TO Pimephales promelas Rafinesque. J. Wat. Poll. Contr. Fed., Part I, pp. 243-254; Selected Water Resources Abstracts, 3(17): p. 32.

The primary objective of this bioassay was to determine the chronic toxicity of Linear Alkylate Sulfonate to the fathead minnow using laboratory fish production index as the measure of effect. The results of this study indicate that lethality of LAS to newly hatched fry was the most critical factor found within the precision of testing methods. An experimental concentration of 0.63 mg/l LAS was determined as the maximum acceptable concentration. The application factor for LAS for this species and water lies between 0.63/4.35 and 1.2/4.35 or approximately 14 and 28 percent of the 96-hr TLm value. A LAS concentration between 14 and 28 percent of the 96-hr TLm value concentration, determined with the species of concern may estimate the maximum acceptable concentration for long-term exposure of these species. This application factor for LAS was the largest of any toxicant studied at the Newtown Fish Toxicology Laboratory. -- Sjolseth.

12564. Yashouv, A., E. Berner-Samsonov, and K. Reich (Fish Culture Research Station - Dor, Israel). 1970. FORCED SPAWNING OF SILVER CARP. Bamidgeh, 22(1): 3-8.

Silver carp females were injected with hypophysis extract in physiological solution. The males generally received one third or one fourth of the amount injected to females. Initial experiments carried out in May indicated that it would be necessary to inject each fish repeatedly in order to obtain positive results. In 16 experiments, negative results were obtained in 6 cases. Of the 10 experiments giving positive results, successful spawning occurred in 5 experiments, i.e., the fish reached spawning condition, their eggs were fertilized, and embryos developed. The remaining 5 experiments gave incomplete results in which a slight spawning occurred, but the eggs could not be fertilized. It is possible to conclude from the experiments and observations that a considerable percent of silver carp reaches sexual maturity during the 2nd year of growth under pond conditions in Israel. (From authors)

12565. Dadzie, Stephen (Fish Culture Res. Sta., Dor, Israel). 1970. PRELIMINARY REPORT ON INDUCED SPAWNING OF Tilapia aurea. Bamidgeh, 22(1): 9-13.

Human Chorionic Gonodotropin was more effective and consistent in inducing spawning in T. aurea than all the other hormones used singly. When used in combination with carp pituitaries, the best results were obtained. The effects of carp pituitary and Luteinizing Hormone used singly took some time to be realized. Since the fish used in the investigation had intact pituitaries, spawning of the fish treated with the hormones in question could easily have been influenced by the

fishes own pituitaries. These facts make it difficult to assess the effectiveness of the last two hormones in inducing spawning in T. aurea. (From auth. discussion).

12566. Dadzie, Stephen (Fish Culture Res. Sta., Dor, Israel). 1970. LABORATORY EXPERIMENT ON THE FECUNDITY AND FREQUENCY OF SPAWNING IN Tilapia aurea. Bamidgeh, 22(1): 14-18.

Sixty-eight mature T. aurea (males and females) ranging between 26 and 332 g. served as materials for these investigations. Seventeen mature female T. aurea had a mean fecundity of 719 eggs and a range of 325 to 4392. The number of eggs produced is a function of the condition of the fish and its size. There is no relation between the size of the eggs and the size of the female. Under tank conditions T. aurea spawns three times per season with four to nine weeks between spawning intervals. Four spawnings is an exception even in cases of induced spawnings. Injection of exogenous gonadotrophins coupled with maintenance of favourable environmental conditions merely reduces the spawning intervals to two to three weeks, but does not increase the spawning frequency. Incubation of the eggs in the mouth of the female parent takes eight to ten days at a temperature of 29°C. Removal of the eggs from the mouth of the female immediately after spawning has the same effect as the administration of exogenous gonadotrophins, i.e., reduces the spawning interval to 2 - 3 weeks, and does not increase the frequency of spawning. (From auth.)

12567. Mires, D. (Ministry of Agriculture, Extension Service, Accre, Israel). 1970. PRELIMINARY OBSERVATIONS ON THE EFFECTS OF SALINITY AND TEMPERATURE OF WATER CHANGES ON Mugil capito FRY. Bamidgeh, 22(1): 19-24.

Mullet fry (Mugil cephalus and M. capito) are caught every year in October - February, by the millions and stocked in freshwater ponds where they are reared together with carp and tilapia. The loss of fry is very high - more than 50%. The purpose of this work was to determine the sensitivity of mullet fry to changes in salinity and temperature. All tests were carried out under field conditions so that temperature changes were not particularly regular and at a planned rate. It seems quite clear that mullet fry suffer very much from sudden changes of temperature, but do not suffer from sudden changes of salinity. A period of 15 minutes of tempering seems sufficient for M. capito to survive a 10° change of temperature. (From auth.)

12568. Swingle, Wayne E. (Agricultural Exp. Sta., Auburn Univ., Auburn, Ala.) 1965. LENGTH-WEIGHT RELATIONSHIPS OF ALABAMA FISHES. From: River and Impoundment Surveys, 1949-1964, Zoology-Entomology Dept. Series, Fisheries No. 3, 87 p.

Tables are presented containing length-weight data of Alabama fishes from river and river impoundment surveys conducted by the fisheries staffs of Auburn University Agricultural Experiment Station and the Alabama Department of Conservation, and those surveys made in cooperation with the Tennessee Valley Authority, Georgia Game and Fish Commission, and the Florida Game and Freshwater Fish Commission. The values presented in the tables represent data collected during the period of 1949 to 1964.

12569. Beckert, Heino. 1967. CULTURE OF SOME COMMON FISH PARASITES FOR EXPERIMENTAL STUDIES. Agric. Exp. Sta. Auburn Univ. Zoology-Entomology Dept. Series, Fisheries No. 5, 28 p.

Fish parasite cultures in the laboratory constitute an important aspect of research on control of these organisms. Basic information about the organism is a prerequisite to effective parasite control. Necessary information includes host range, life cycle, and special environmental conditions either advantageous or detrimental to the parasite, such as the organism's response to temperature, oxygen content, pH, and salinity of the water. To obtain information of this type the parasite must be available in sufficient numbers to permit study and experimentation. Detailed cultural techniques are given for Ichthyophthirius multifilis, Cleidodiscus pricei, and Lernaea cyprinacea.

12570. Mason, John W., and Gerald D. Wegner (Bur. of Research, Madison, Wis.) 1970. WILD RIVERS FISH POPULATIONS (PINE, POPPLE AND PIKE RIVERS). Dept. of Natural Resources, Madison, Wis., Research Report No. 58, 42 p.

The fish populations and water quality of the Pine, Popple and Pike Rivers and their tributaries were studied from 1966-68 to document existing conditions in wild rivers and serve as a basis for future protection and use. The Pine and Popple Rivers are fast-moving rivers, with falls and rapids, although there are also extensive reaches of quiet, slow-moving water. The Pike River is narrower and deeper, and has more bank and instream cover. Warmwater fish predominated in the lower Pine. Trout were found in all three rivers, but productivity is restricted by low water fertility, high summer temperatures and cold winter temperatures. The north branch of the Pike River is the best stretch of trout water in the wild rivers system. Higher standing crops and better trout reproduction reflect greater productivity. In future management emphasis should be placed on maintaining the highest quality fishery possible. Stocking of brown trout will be necessary to facilitate the buildup of this species in the wild rivers. Browns are more likely to grow to larger size and provide a more sustained fishery than the other trout species. Trout should be stocked in areas of river having high gradient, and in stretches where wild populations are the lowest. (Authors)

12571. Brynildson, Oscar M., and James J. Kempinger (Bur. of Research, Hartman Creek State Park, Waupaca, Wisconsin). 1970. THE FOOD AND GROWTH OF SPLAKE. Dept. of Natural Resources, Madison, Wis., Research Report No. 59, 41 p.

Splake (brook trout X lake trout), released as fall fingerlings and spring yearlings in Pallette Lake, Vilas County, Wisconsin, survived and grew at similar rates during 5 years of observation. Cladocerans and copepods less than 1 mm long were not present in the stomach contents of splake 7 to 23 inches in total length. When the splake were 1 to 4 years of age, aquatic and terrestrial insects and planktonic crustaceans occurred most frequently in over 300 stomachs examined. Although fish began appearing in stomachs of splake which were 3 years old, not until the splake reached the age of 5 years and more and ranged in length from 15 to 23 inches were fish their most important food. In the stomachs of splake 5 years of age and older, fish constituted nearly 100 percent of the total food items. Growth of the splake in length was highly variable, and the average coefficient of condition (R) was low after 4 years residence in Pallette Lake. The high average (R) of the splake when stocked was not regained until nearly 5 years in Pallette Lake. The largest splake recorded (25.5 inches in total length - 8.85 lbs.) from Pallette Lake was caught on hook and line in December, 1969. The splake were readily caught on hook and line when collecting splake for growth and food studies before they were 4 years of age. By the time the splake reached age 4 and older, the stock level had declined through natural mortality and splake were no longer readily caught; less than 2 percent of the splake stocked were recorded in a permit-type creel census through 1969. (Authors)

12572. Combs, Ralph M. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1969. EMBRYOGENESIS, HISTOLOGY AND ORGANOLOGY OF THE OVARY OF Brevoortia patronus. Gulf Research Reports, 2(4): 333-434.

One hundred ninety-one large scale menhaden, Brevoortia patronus, ranging in age from larvae to sexually mature females were used in this study. Collections were made in the littoral and shallow offshore waters of the Gulf of Mexico from Dauphin Island, Alabama, westward to West Bay, Louisiana, at intervals throughout a five year period. Using standard paraffin techniques a number of staining methods were employed. Cytological and histological accounts are presented of the tissue elements of the gonads beginning with inception in the larvae, sexual differentiation to the sexes, and the cyclic changes associated with oogenesis and spawning in the mature fish. The microscopic developments occurring during these periods are correlated with gross features of the organ, the ages of specimens, and with seasonal periods. An account of the morphology and physiology of atretic oocytes and ovulated follicles is presented. Using the ovarian components as an index, the time and duration of the spawning season is established as

occurring from late October to February or early March with some variance due to environmental factors. From the study, it is possible to postulate that this species exhibits intermittent total spawning in the Gulf. (Auth.)

12573. Saito, A., and L. W. Regier. 1970. DETERMINATION OF TOTAL CAROTENOID PIGMENTS IN TROUT AND SALMON FLESH. Fish. Res. Bd. Can., Halifax Lab., Nova Scotia, New Series Circular No. 36, 3 p.; Comm. Fisheries Abstracts, 23(9): p. 29.

In the evaluation of fish from culture or farming systems it is desirable to have a measure of the pigmentation of the fish flesh. A moderately pink tissue in the salmonids is quite desirable while an unpigmented grayish-white flesh does not have the same appeal. The pigments of fish of the salmonid species consist mainly of carotenoids and are acquired through the diet from such foods as crustaceans, i. e. shrimp, crab, etc. The dominant carotenoid in the muscle tissues is usually astaxanthin with several others in minor amounts. In fish receiving a diet containing plant material, a significant amount of a xanthophyll (lutein) may also be present. The characteristic light absorption spectra of the carotenoids are used for identification and estimation of these compounds. Most of them have quite similar molar extinction coefficients at a wave length of 460 nanometers. Thus, the amount of light absorption at this wavelength of an organic extract of the flesh can be taken as a measure of the total carotenoid content. This relationship is the basis for the ... procedure (described here) .... The concentration of carotenoid giving a desirable color to the fish flesh is 20% of dried shrimp waste (containing about 10 mg carotenoids/100 g dry wt.) in the diet. If the values are lower, then additional quantities of shrimp waste or similar material should be incorporated in the diet. A period of 12 weeks on a diet adequate in carotenoids is required to obtain the desired pigmentation. Higher levels are to be discouraged since it gives the fish flesh an artificial appearance. More detailed information on the inclusion of carotenoid rich materials in the diets of farmed fish will be issued as soon as the present studies are completed.

12574. Coon, Kenneth L., and James E. Ellis (Comm. Catfish Culturist, P. O. Box 476, Tuckerman, Arkansas). 1970. TOW-BAR SYSTEM FOR SEINING FARM PONDS. Fishery Industrial Research, 6(2): 83-88; Commercial Fisheries Abstracts, 23(9):p. 32.

A simple, relatively inexpensive, tractor or truck tow-bar system was developed and tested to remove farm-cultured fish from ponds up to 450 feet wide and of any length. The advantages of the system over manual methods include: (1) when the system is used, draining the pond is unnecessary, (2) seining is more convenient and faster, and (3) increasing the efficiency in this manner reduces the cost per acre of water seined and per pound of fish handled. The main limiting factor is the adequacy of the levees or shore of the pond to accommodate the tractors or trucks. (Authors summ.)

12575. Lawrence, J. M. (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1968. COMPARATIVE CONCENTRATIONS OF SELECTED MACRO AND MICRO NUTRIENTS IN WATER, SUSPENDED MATTER, HYDROSOL, PLANTS, AND FISH FROM RESERVOIRS ON CHATTAHOOCHEE RIVER. Reprint from Proc. of the Fourth American Water Resources Conf. Nov. 18-22, 1968, pp. 368-378.

The chemical composition of water and suspended matter in reservoirs on Chattahoochee River apparently reflected the abundance of soluble elements in the watershed. The abundance of the 6 elements in raw waters occurred in following order: Ca > Mg > Fe > Zn > Mn > Cu. The abundance of 6 elements in broad-leaved aquatic plants occurred in following order: Ca > Mg > Fe > Mn > Zn > Cu, but in the grass species they occurred in this order: Mg > Ca > Mn > Fe > Zn > Cu. The abundance of 6 elements in fish occurred in the following order: Ca > Mg > Fe > Zn > Cu > Mn. These data indicate that similar studies must be undertaken on many watersheds to provide information for an adequate evaluation of the composition of an aquatic environment. (Auth. summ.)

12576. Tsai, Chu-fa (Nat. Res. Inst., Univ. of Maryland, College Park, Maryland). 1970. CHANGES IN FISH POPULATIONS AND MIGRATION IN RELATION TO INCREASED SEWAGE POLLUTION IN LITTLE PATUXENT RIVER, MARYLAND. Chesapeake Science, 11(1): 34-41.

Increased sewage pollution in the Little Patuxent River, Maryland, from 1958 to 1967, brought about changes in fish migration, in abundance of resident species, and in the fish community in the stream. The upstream migration of white catfish, white perch, white sucker, and northern redhorse was apparently adversely affected by the increased sewage pollution. The downstream ranges and abundance of resident smallmouth bass and northern hog sucker decreased as did the upstream ranges and abundance of black crappie. Brown bullhead, golden shiner, redbreast sunfish, and bluegill showed different degrees of changes in abundance without reduction in their distribution ranges. Number of species and fish abundance decreased drastically in the area immediately below the chlorinated sewage effluents. Downstream, in the organically enriched areas, the fish community composition changed although there were no changes in number of species. (Auth.)

12577. Markle, Douglas F., and George C. Grant (Virginia Inst. of Marine Sci., Gloucester Point, Virginia). 1970. THE SUMMER FOOD HABITS OF YOUNG-OF-THE-YEAR STRIPED BASS IN THREE VIRGINIA RIVERS. Chesapeake Science, 11(1): 50-54.

The dominant food items in striped bass, Morone saxatilis (Walbaum), less than 70 mm in fork length were mysids in the York River samples and insects in those from the James River. Stomach contents from larger striped bass were dominated by fish (York River) and decapod shrimp (James River). The primary physical difference between collecting sites in these two rivers was salinity. Most James River collections were taken from salinities of less than 5 °/oo, whereas the majority of York River stations exceeded 10 °/oo. The food of Rappahannock River striped bass was more diverse than that of York and James populations, containing items in common with both. Salinities at Rappahannock stations ranged from 1.5 to 14.5 °/oo. (Authors)

12578. U. S. Department of the Interior, Bur. of Sport Fisheries & Wildlife. 1970. REPORT TO THE FISH FARMERS. U. S. Dept. of Interior, Div. of Fishery Research, Resource Publication 83, 124 p., illus.

Contents include: fish farming, an aquacultural success story; channel catfish culture methods; catfish feeds and feeding; dealing with parasites and diseases; pond management; improving stocks of channel catfish; how to do it; catfish farming costs; national fish hatcheries and channel catfish; the culture of bait fishes; the future for fish farming; what to read; and who to talk to.

12579. Mounib, M. S., and J. S. Eisan (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1969. ALANINE AND ASPARTATE AMINOTRANSFERASES IN EGGS AND SPERM OF FISH. Life Sciences, No. 8 (Part II): 531-534; 1969 Studies, Fish. Res. Bd. Canada, Part 2, No. 1342, pp. 203-206, 1970.

Alanine and aspartate aminotransferases were found to be active in eggs and egg fluid of salmon, herring, cod and haddock, and in spermatozoa and seminal plasma of salmon, herring and cod. The activity of the two aminotransferases studied was greater in sperm than in eggs. There were differences among fish in the pattern of activity of the aminotransferases in eggs and egg fluid, and also in sperm and seminal plasma. (Authors summ.)

12580. Holmes, W. N., and L. N. Lockwood (Dept. of Biol. Sci., Univ. of Calif., Santa Barbara, California). 1970. SOME ASPECTS OF OSMOREGULATION IN THE BARRED SURFPERCH (Amphistichus argenteus). Journal of Zoology, 161(1): 1-14.

The osmoregulatory abilities of Amphistichus argenteus were examined following transfer from hypertonic to hypotonic sea-water. Although some regulatory capacity was evidenced by an increase in glomerular filtration during acclimation to hypotonic sea-water, the fish did not appear able to counter the tendency to lose electrolytes in this medium. When compared to a truly euryhaline

species, such as Salmo gairdneri, A. argenteus possessed only a limited capacity to survive in a hypotonic environment. (Authors)

12581. Gunter, Gordon, and Gordon E. Hall (Gulf Coast Res. Lab., Ocean Spring, Mississippi). 1965. A BIOLOGICAL INVESTIGATION OF THE CALOOSAHATCHEE ESTUARY OF FLORIDA. Gulf Research Reports, 2(1): 1-72.

The scope and purpose of this work was to: a) review the history of the Caloosahatchee River and analyze the problems concerned with discharges into the estuary; b) present biological data from investigations of the Estuary made at different times during the years 1957 to 1960, inclusive; c) determine the biological effects of operation of Moore Haven and Ortona Locks, and the planned lock and dam at Olga with reference to important indicator species within the lower river and estuary; and d) determine operational procedures, practicable within specific operational requirements of the project, which would be either beneficial or of least damage to estuarine fishes and fishing. (From authors introduction)

12582. Vik, Rolf, Odd Halvorsen and Karin Andersen (Zoologisk Museum, Oslo, Norway). 1969. OBSERVATIONS ON Diphyllobothrium PLEROCERCOIDS IN THREE-SPINED STICKLEBACKS, Gasterosteus aculeatus L., FROM THE RIVER ELBE. Nytt Magasin for Zoologi, 17(1): 75-80.

To secure material from the area where "the new taxonomy" of Diphyllobothrium started for comparison with material from Norwegian waters, and to 'calibrate' our observations with those of Kuhlow, sticklebacks from the river Elbe were examined for Diphyllobothrium plerocercoids. The Diphyllobothrium plerocercoids found could be recognized as D. dendriticum and D. vogeli as described by Kuhlow even if the appearance of the larvae did not agree with Kuhlow's figures in every detail. D. vogeli plerocercoids were found not to be restricted to the liver of the fish only, but a preference for this site is present in this species. Plerocercoids of D. dendriticum were not only found free in the body cavity, but many such larvae were on the contrary encysted in different sites in the stickleback host. (Authors)

12583. Halvorsen, Odd (Zoological Museum, Oslo, Norway). 1969. STUDIES OF THE HELMINTH FAUNA OF NORWAY XIII: Diplozoon paradoxum Nordmann 1832, FROM ROACH, Rutilus rutilus (L.), BREAM, Abramis brama (L.) AND HYBRID OF ROACH AND BREAM. ITS MORPHOLOGICAL ADAPTABILITY AND HOST SPECIFICITY. Nytt Magasin for Zoologi, 17(1): 93-103.

Diplozoon found on roach and bream conformed with D. homoion and D. paradoxum, but a morphological and ecological study of parasites from these hosts together with parasites from hybrids of roach and bream shows that they are all parasitized by the same species, D. paradoxum. Differences in the host's ecology may account for variations in infections. D. paradoxum has a rheophilic nature, lives for about a year and the main egg production period is in June in the locality studied. (Auth.)

12584. Williams, H. H. (Natural History Dept., Marischal College, Univ. of Aberdeen, United Kingdom). 1969. THE GENUS Acanthobothrium Beneden 1849 (CESTODA: TETRAPHYLLIDEA). Nytt Magasin for Zoologi, 17(1): 1-56.

Twelve species of Acanthobothrium were found in 11 of 26 host species. A. edwardsi sp. nov. occurred in Raja fullonica and A. tripartitum sp. nov. in R. micro-ocellata. Acrobothrium Baer, 1948 is mentioned relative to A. typicum Olsson, 1872. The taxonomy, host-specificity, ecology and biology of Acanthobothrium are discussed. Sixty-nine species are accepted and a host-parasite list is given. Almost 200 references are cited. (Auth.)

12585. Lien, Leif (Zoologisk Museum, Oslo, Norway). 1970. STUDIES OF THE HELMINTH FAUNA OF NORWAY XIV: Triaenophorus nodulosus (Pallas, 1760) (CESTODA) IN BOGSTAD LAKE. II. DEVELOPMENT AND LIFE SPAN OF THE PLEROCERCOIDS IN PERCH (Perca fluviatilis L., 1758). Nytt Magasin for Zoologi, 18(1): 85-96.

The plerocercoids were divided into four categories: immature, non-degenerate, degenerating and degenerate. With a high intensity of infection, there was a lower frequency of non-degenerate worms. This might be a particular form of crowding effect. Non-degenerate worms showed seasonal variations which indicate a life span of about one year. Perch older than five years showed a decrease in frequency of non-degenerate and degenerating worms. On the basis of frequency of non-degenerate worms in one year class and the frequency of degenerating plerocercoids in a class one year older, the degenerating plerocercoids may be expected to live between one and two years. Overall the longevity of plerocercoids is two to three years. (Auth.)

12586. Peltier, W. H., and E. B. Welch (Envir. Biol. Branch, Div. of Health and Safety, TVA, Muscle Shoals, Alabama). 1970. FACTORS AFFECTING GROWTH OF ROOTED AQUATIC PLANTS IN A RESERVOIR. Weed Science, 18(1): 7-9.

Water samples were taken from Pickwick Reservoir from 1965 through 1968 and the nitrogen and phosphorus content determined. The nitrogen and phosphorus content over a period of 3 years was not related to the year-to-year plant growth. Physical and climatic data were obtained from 1961 through 1968, and it was found that available light was controlled by the amount of rainfall and ensuing reservoir elevation during the critical plant growth period in April and May. Available light was correlated with the 2 years of severe infestations. (Authors)

12587. Rodgers, Charles A. (Fish-Pesticide Res. Lab., Bur. Sport Fisheries and Wildlife, Columbia, Missouri). UPTAKE AND ELIMINATION OF SIMAZINE BY GREEN SUNFISH (Lepomis cyanellus Raf.). Weed Science, 18(1): 134-139.

The uptake and release of 2-chloro-4, 6-bis (ethylamino)-s-triazine (simazine) by green sunfish (Lepomis cyanellus Raf.) were measured during a 3-week exposure to either non-labeled or symmetrically ring-labeled ^{14}C-simazine. Exposure was by feeding (3 and 10 mg/kg body wt) or bath (1 and 3 ppm). To determine the retention of simazine, treated fish remaining after exposure and sampling were placed in fresh water for 4 weeks. This water was changed weekly. Fish in the bath absorb simazine in amounts directly proportional to the concentration in the water: i. e., 0.95 and 2.29 ppm total residue after 3 weeks exposure to 1.0 and 3.0 ppm, respectively. Little or no simazine was found in feed-exposed fish 72 hr after feeding. Almost all of the residue was in the viscera. No simazine residue was detected in fish from the water bath exposure after they had been in fresh water 7 days. (Auth.)

12588. Yeo, R. R. (Crops Res. Div., Agr. Res. Serv., U. S. Dept. of Agriculture and Dept. of Botany, Univ. of California, Davis, California). 1970. DISSIPATION OF ENDOTHALL AND EFFECTS ON AQUATIC WEEDS AND FISH. Weed Science, 18(2): 282-284.

Rates of dissipation, control of troublesome aquatic weeds, and toxicity to fish by the disodium and dipotassium salts of 7-oxabicyclo (2, 2, 1)-heptane-2, 3-dicarboxylic acid (endothall) in farm reservoirs and in growth pools were studied from 1964 to 1967. In 4 out of 14 reservoir applications, initial concentrations of 0.3 to 1.4 ppm dissipated to near the limit of detection in 8 to 20 days. In the other 10, the dissipation ranged from 23 to an increase of 160% in 12 days. The average dissipation was 71%. In growth pools, initial concentrations of 0.5 to 4.0 ppm of endothall dissipated to 0.26 to 2.5 ppm in 12 days. (Auth.)

12589. Jossi, Jack W. (Bur. of Comm. Fisheries, Miami, Florida). 1970. ANNOTATED BIBLIOGRAPHY OF ZOOPLANKTON SAMPLING DEVICES. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Special Scientific Report - Fisheries No. 609, 90 p.

The bibliography gives references to publications issued since 1873. It has information on many characteristics of these devices. The references are listed by author and by KWIC index.

12590. Maitland, Peter S. (The Nature Conservancy, Edinburgh, Scotland). 1969. THE REPRODUCTION AND FECUNDITY OF THE POWAN, Coregonus clupeoides Lacepede, IN LOCH LOMOND, SCOTLAND. Proc. roy. Soc. Edinb. (B), 70(3): 233-264.

Adult powan, Coregonus clupeoides Lacepede, in Loch Lomond show regular diurnal and seasonal migrations, connected normally with either feeding or reproduction. As the breeding season approaches, most of the adult population gather in deep water (usually in the vicinity of the areas of wave-washed gravel and small stones in shallow water, which form the main spawning grounds). The male fish start to move on to these grounds rightly towards the end of December each year; at the end of this month, but mainly during January, the females ripen and join them for spawning. This is completed by the beginning of February and the population then gradually disperses over the rest of the loch. The present fecundity estimates, carried out for female powan during two seasons, are in general agreement with those found for Coregonus elsewhere in the Palearctic region. They give an average of 5750 eggs per adult fish, the mean fork length of which was just over 27 cm. Though there is a positive correlation between the number of eggs produced and the size of the females, it is not a strong one. After being laid, the eggs immediately undergo a heavy mortality and are eaten in considerable numbers by trout, Salmo trutta L., powan, roach, Rutilus rutilus (L.), Phryganea larvae, and various other animals. The adult powan, too, are preyed upon extensively at this time in certain parts of Loch Lomond by pike, Esox lucius L. The reproductive ecology of the powan shows several basic similarities to that of other Salmonidae in the British Isles, the main features fitting well with what has been postulated about the origin and distribution of the family in this country. (Auth. synopsis)

12591. Maitland, Peter S. (Dept. of Zool., Univ. of Glasgow, Glasgow, Scotland). 1967. THE ARTIFICIAL FERTILIZATION AND REARING OF THE EGGS OF Coregonus clupeoides Lacepede. Proc. roy. Soc. Edinb. (B), 70(1): 82-106.

Past studies of the relationships between different populations of Coregonus have demonstrated the great plasticity of form exhibited by this genus throughout the Palearctic region. In addition to standard morphological accounts, hybridization and rearing studies are important in attempting to assess the relationships between different races, and this paper describes some initial work which has been carried out in this direction. The development of eggs of the Loch Lomond powan, Coregonus clupeoides Lacepede, has been studied in the laboratory and shown to follow a definite pattern. The average incubation period at 6-9°C is 65 days though considerable variation in this time occurs. Eggs and sperm kept separate and without water still showed 50 percent fertilization after 3 days but none after 6 days. Hybrids of two races of Coregonus, one living in Scotland, the other in Wales, were produced by bringing together eggs and sperm which had been kept cool and dry during transport. The value of these experiments in relation to past and future research is discussed. (Auth. synopsis)

12592. Gramoni, Rosangela, and M. A. Ali (Dept. des sci. biol., Fac. des sci., Univ. de Montreal, Montreal, Canada). 1970. CHANGES IN THE ERG COMPONENTS OF THE LANDLOCKED SALMON (Salmo salar ouananiche, McCarthy) DURING DARK- AND LIGHT-ADAPTATION. Rev. canad. Biol., 29(1): 35-47.

ERGs were recorded from the intact eyes of anaesthetized fish. Temperature, light intensity and stimulus duration were kept constant. Changes in the latencies and amplitudes of the a-, b-, and d- waves were studied as a function of time in dark and light following prior adaptation to light or dark. Curves indicating these changes are presented. Although there are general similarities, no direct correlation between the courses of electroretinographic and retinomotor adaptation could be established. These results indicate that the problem of the c-wave is more complex than hitherto thought to be. (Authors)

12593. Hickling, C. F. (Trop. Fish Cult. Res. Inst., Malacca, Malaya). 1967. ON THE BIOLOGY OF A HERBIVOROUS FISH, THE WHITE AMUR OR GRASS CARP, Ctenopharyngodon idella Val. Proc. roy. Soc. Edinb. (B), 70(1): 62-81.

The important macrophyte-feeding cyprinid fish Ctenopharyngodon idella Val., the white amur or grass carp, is native to temperate climates. The present paper is concerned with its biology when transplanted to Malacca, a tropical research station in latitude 2°17' N. At this station, the fish has a faster growth-rate, and may mature at an earlier age and smaller size than in its native habitat. There are no marked seasonal changes at Malacca, and in these conditions the grass carp shows no spawning cycle, but some fish are ripe at any time of the year. While the testes of the males appear to develop normal milt, the ovaries in the fish examined seldom produced as many eggs as in their native habitat, and the eggs themselves have been shown to be mostly defective and to undergo early atresion. Consequently, though the ovulation of eggs of normal size was induced by pituitary injection in nineteen out of forty-eight trials, no success was got in the artificial fertilization of the eggs, though elsewhere success has been got in 25 percent and more of trials. It is suggested that this fish may need the external stimuli which are associated with its natural spawning season to develop normal fertile eggs. (Auth. synopsis)

12594. Ali, M. A., Ruth Hubbard, and G. Wald (Dept. des Sci. biol., Fac. des sci., Univ. de Montreal, Montreal, Canada). 1970. SCOTOPIC VISUAL PIGMENTS IN THE ALBINO BROOK TROUT Salvelinus fontinalis. Rev. canad. Biol., 29(2): 153-156.

The scotopic visual pigment in the two-year-old albino brook trout, as extracted by the fluotation method, is a mixture of rhodopsin (λ max 500 nm) and porphyropsin (λ max 518 nm). The λ max of the total bleach at 510 nm corresponds fairly well to that of the two-year-old albino rainbow trout and of the pigmented brook trout. (Authors)

12595. Hanyu, Isao, and Hiroshi Niwa (Dept. of Fish., Fac. of Agric., The Univ. of Tokyo, Tokyo, Japan). 1970. PINEAL PHOTOSENSITIVITY IN THREE TELEOSTS, Salmo irideus, Plecoglossus altivelis AND Mugil cephalus. Rev. canad. Biol., 29(2): 133-140.

Spontaneous nervous discharge was recorded from the pineal vesicle in Salmo irideus, Plecoglossus altivelis and Mugil cephalus. Inhibition of the spontaneous activity occurred only in response to a light stimulus. The time course of the inhibitory response, which varied among species, was markedly retarded in the dark-adapted state. The threshold of the response declined exponentially during dark adaptation, the lowest values being 2×10^{-2}, 10^{-4}, and 6×10^{-5} lux, for Salmo, Mugil, and Plecoglossus, respectively. Peaks of the spectral sensitivity were found to lie between 495 and 525 mμ. No Purkinje shift was observed. Most single units discharged in fairly regular rhythms, and the discharging frequency was inversely related to the level of adapting illumination. The pineal of these teleosts is considered to mediate detection of shadows and darkness. Features characteristic of the pineal photoreception are also discussed. (Authors)

12596. Laurent, Pierre (Lab. de neurophysiol. gen. du College de France, Paris, France). 1969. ACTION OF pH AND P O_2 ON THE MEMBRANE POTENTIAL OF EPITHELIAL RECEPTOR CELLS IN THE PSEUDOBRANCH OF A TELEOSTEAN FISH. Rev. canad. Biol., 28(3): 149-155.

In the teleost pseudobranch, an arterial chemoreceptor, we were able to record intracellular potentials which are very likely the membrane potentials of the epithelial cells. The potential changes reversibly, from 15 mV to 55 mV with P O_2 and (or) pH shifts, at an approximate rate of 6 mV min-! Accordingly each pair of physiological P O_2 and pH values sets up a defined membrane potential. These data are consistent with some ionic exchanges between cells and extracellular spaces where afferent nerve endings were located. They support an hypothesis of the stimulatory mechanism of the afferent nerve endings. (Auth.)

12597. Niwa, H., and T. Tamura (Fish. Lab., Fac. of Agr., Nagoya Univ., Nagoya, Japan). 1969. INVESTIGATION OF FISH VISION BY MEANS OF S-POTENTIAL II. SPECTRAL SENSITIVITY AND COLOUR VISION. Rev. canad. Biol., 28(2): 79-88.

It appears from this and a previous investigation that the maximum of a dominant L-response in fresh water fishes is displaced towards the longer wavelengths of the spectrum when compared to that of the marine fishes. This spectral shift parallels that of the rod pigments in marine and fresh water fishes. However, S-potentials are recorded from the isolated retina in which the rod outer segments are mostly removed. Our results lend support to the view that there may be a chemical relationship between rod and cone pigments. Further, there appears to be a correlation between the maximum wavelength of the dominant L-response and the spectral quality of the environment. The C-response seems to be related to colour vision. (Authors)

12598. Hubbs, Clark, Michael M. Stevenson, and Alex E. Peden (Dept. of Zool., The Univ. of Texas, Austin, Texas). 1968. FECUNDITY AND EGG SIZE IN TWO CENTRAL TEXAS DARTER POPULATIONS. The Southwestern Naturalist, 13(3): 301-324.

More than 1500 measurements were made of mature eggs from females obtained from two populations of central Texas darters (Etheostoma spectabile from the Llano River at Junction and Etheostoma lepidum from the South Concho River 4 miles south of Christoval). Junction eggs averaged 1.515 ± 0.002 mm and those from the South Concho 1.301 ± 0.031 mm. Female size did not seem to influence egg size, with small eggs as likely in large as in small females. Eggs from females collected in November and April were smaller than those from fish of the same population collected in December through March. More than 2500 counts were made of egg complements of females from the same two populations. The number of eggs increased geometrically with female size, and the rate of increase approximates a squared relationship. Apparently digestive absorptive surface is more limiting than coelomic space. The largest females may have fewer eggs than medium sized females, especially toward the end of the breeding season. Females collected in February and adjacent months have more eggs than those obtained in other months. The difference is caused by more eggs in equivalent sized females. (Authors)

12599. Renfro, J. Larry, and Loren G. Hill (Dept. of Zool., Univ. of Oklahoma, Norman, Oklahoma). 1970. FACTORS INFLUENCING THE AERIAL BREATHING AND METABOLISM OF GARS (Lepisosteus). The Southwestern Naturalist, 15(1): 45-54.

Several factors influencing the rate of aerial breathing and metabolism of young-of-the-year gars were studied. Without access to atmospheric oxygen, the lethal oxygen concentration was found to be approximately 2.45 mg/l at 73F. The average rate of oxygen consumption of these fishes was 0.295 ml O_2/gm/hr. Prevention of aerial breathing produced no observable ill effects on the gars tested provided the dissolved oxygen content of the water was above 3 mg/l. Undoubtedly, the gar's air bladder serves a hydrostatic function as well as a respiration function, and thus complicates the analysis of aerial breathing of these fishes. The temperature acclimation time of alligator gar, based on the rate of aerial breathing, requires approximately 48 hours. (Authors)

12600. Newton, Scott H., and Raj V. Kilambi (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas). 1969. DETERMINATION OF SEXUAL MATURITY OF WHITE BASS FROM OVUM DIAMETERS. The Southwestern Naturalist, 14(2): 213-220.

Sexual maturity of white bass, Roccus chrysops (Rafinesque), was studied in Beaver Reservoir, Arkansas, during the 1967 spawning season. Ovum diameters along with morphological appearance were used to determine size of maturity and to arbitrarily stage ovum development. Most spawning females were in age group II. No age group I females were mature. (Authors)

12601. Sanders, J. E., and J. L. Fryer (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon). 1970. OCCURRENCE OF THE MYXOSPORIDAN PARASITE Myxidium minteri IN SALMONID FISH. J. Protozool., 17(2): 354-357.

The myxosporidan Myxidium minteri was found in 3 recognized hosts, chinook and coho salmon and rainbow trout and 2 new hosts, cutthroat trout and mountain whitefish. Spores in all species examined were found primarily in the gall bladder. Fish infected with this parasite were obtained from both Oregon coastal rivers and Columbia River basin locations. In general the prevalence of infection was higher in the fish in coastal rivers. (Authors)

12602. Blaxter, J. H. S., and Mary Staines (Dept. of Natural History, Univ. of Aberdeen, Aberdeen, Scotland). 1970. PURE-CONE RETINAE AND RETINO-MOTOR RESPONSES IN LARVAL TELEOSTS. J. Mar. biol. Ass. U. K., 50(2): 449-460.

Retinomotor responses have been investigated in the young stages of eight species of teleost and the retinal structure in these and a further two species (pilchard, Atlantic salmon, eel, Macruridae, haddock, nile perch, sand goby, stickleback, lemon sole, sole). In nearly all species the visual cells comprise only cones in the larval stage and there is no movement of retinal masking pigment when the larvae are subjected to changing conditions of illumination. Rearing of four species to metamorphosis shows that the rods develop at this time with concomitant pigment movement during light- and dark-adaptation. In the oceanic leptocephalus stage of the eel and the larva of a deep-sea macrurid the visual receptors comprise only rods. The implications of larval life without the full adult visual equipment, and the nature of the larval receptors are considered. (Authors)

12603. Nasedkina, E. A., and N. F. Pushkareva (TINRO). 1969. AMINO ACID COMPOSITION OF THE SPAWN AND BODY TISSUES OF THE MARITIME PINK SALMON. (Aminokislotnyi sostav ikry i tkanei tela primorskoi gorbushi). Rybnoe Khozyaistvo, December 12, 1969, Moscow, 53-56. Translation from the Russian by Robert M. Howland, Bur. of Sport Fisheries and Wildlife, Narragansett, R. I.

The total content of free amino acids increases according to the degree of ripeness of the spawn especially such as glutamic acid with threonine and tyrosine. The content of the other amino acids remains practically unchanged, with the exception of arginine, which apparently proceeds to the formation of creatine, urea, ornithine, etc. Fertilized spawn contains less free amino acids than the spawn of females before spawning. Fry at the end of nurturing differed from the earlier fry by a lower content of free amino acids. Especially acutely decreased is the content of essential amino acids, which lowers their survivability. In connection with having started feeding, the total content of free amino acids in the tissues reached 210 mg %. The increase occurred due to tyrosine, valine and methionine, phenylalanine and leucine, i. e. all amino acids which proceed in the organism from the liver through the blood and play a large role in the growing organism. Analyses showed that the kidneys and liver (177.3 and 267.0 mg%) of adult fish have the highest content of free amino acids, especially after spawning. The least amounts of amino acids are in the muscles of the fish (stages of ripeness III-IV) and in the testes - at stages II-III. The kidneys differ from the other parts of the body by the presence of cystine (to 3.5 mg %) and increased content of alanine (to 63 mg %). In the testes in contrast to the other organs lysine occurs only as traces. -- Robert M. Howland

12604. Cross, Frank B. (Museum of Natural History, Univ. of Kansas, Lawrence, Kansas). 1970. OCCURRENCE OF THE ARKANSAS RIVER SHINER, Notropis girardi Hubbs and Ortenburger, IN THE RED RIVER SYSTEM. The Southwestern Naturalist, 14(3): p. 370.

12605. Merrell, Theodore R., Jr. (Bur. of Comm. Fish. Biol. Lab., Auke Bay, Alaska). 1970. ALASKA'S FISHERY RESOURCES - THE CHUM SALMON. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Fish. Leafl. No. 632, 7 p., illus.

The chum salmon, Oncorhynchus keta, is the most widely distributed and second most abundant of the five Pacific salmon. It is one of Alaska's valuable fishery resources. Chum salmon spawn in late summer and fall--some in small streams near the ocean and others in large rivers in which they travel as far as 1,500 miles from the ocean. The young hatch in midwinter but stay in the stream gravel until spring, when they emerge and migrate to sea. They spend 2 to 4 years in the sea and weigh about 10 pounds when they return to spawn and die in their native stream. Most chum salmon are taken in purse seines and are canned; hundreds of thousands are caught in gill nets and fish wheels for human and dog food. This fishery is mostly in the large rivers that run into the Bering and Chukchi Seas of northern Alaska. Little biological research has been done on chum salmon, so less is known about them than any other Pacific salmon. (Auth.)

12606. Fijan, Nikola (Dept. Zoology-Entomology, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. SYSTEMIC MYCOSIS IN CHANNEL CATFISH. Bull. Wildlife Disease Assoc., Vol. 5, pp. 109-110., illus.

An epizootic of an apparently undescribed mycosis of channel catfish (Ictalurus punctatus, Rafinesque) was encountered in a small privately owned pond in Central Alabama. The fungus was identified as belonging to the family Dematiaceae, order Montiliales. The pathogenicity of the fungus was tested on channel catfish, white catfish and bluegills. Five fish of each species were injected intraperitoneally with a suspension obtained from the fungus growth on the slanted Mueller-Hinton medium which had been incubated for seven days at 25C. The fish were kept at 18C. The first channel and white catfish died 13 days after injection and the first bluegill died after 19 days. All fish were dead within a month. Peritonitis and abscesses in internal organs developed in all fish. In several catfish, the abdominal wall was perforated and the anus was inflamed. Fungal hyphae were present in large numbers in all dead fish and the organism was re-isolated from one of the experimental channel catfish. (From auth.)

12607. Fijan, Nikola N. (Fish. Div., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. ANTIBIOTIC ADDITIVES FOR THE ISOLATION OF Chondrococcus columnaris FROM FISH. Applied Microbiology, 17(2): 333-334.

As single additives, polymyxin B and neomycin increased the number of discrete colonies of C. columnaris and suppressed the growth of other bacteria, but in combination they gave better and more consistent results. In two cases, colonies of C. columnaris were not found on plates of Cytophaga agar without antibiotics, whereas its colonies were numerous on plates with additives. (From auth.)

12608. Fijan, Nikola N. (Fish. Div., Agric. Exp. Sta., Auburn Univ., Auburn Alabama). 1968. THE SURVIVAL OF Chondrococcus columnaris IN WATERS OF DIFFERENT QUALITY. III Symposium de la Commission de l'Office International des Epizooties pour l'Etude des Maladies des Poissons, Stockholm, Sweden, 23-27 September, 1968, 7 p.

The review of the literature and author's experience show columnaris disease to be quite important and widespread in the United States. Although recent publications indicate the presence of the disease in other parts of the world, its range and occurrence are not well known. Results of the experimental work on the survival of Chondrococcus columnaris in waters of different quality indicate that the organism can persist in water for prolonged periods of time, especially in those of higher hardness and organic matter content. Survival time was reduced significantly in water with a pH of 6.0. It was less affected by pH values of 6.5, 9.5 and 10.0 and by the softness of water containing no organic matter. (Auth. summ.)

12609. Chien, Shih Ming (Dept. of Zoology-Entomology, Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. MONOGENEAN PARASITES OF Hypentelium nigricans WITH DESCRIPTION OF A NEW SPECIES. J. Parasit. 55(4): 737-739.

A new species of Ancyrocephalinae, Pseudomurraytrema rogersi sp. n., is described and three species, namely, Anoncohaptor anomalum Mueller, 1938; Pseudomurraytrema etowanum Rogers, 1966; and Gyrodactylus viriosus Wellborn and Rogers, 1967, have been recovered from Hypentelium nigricans collected from Rock Creek, Fannin County, Georgia. (Auth.)

12610. Rogers, Wilmer A. (Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. Ergasilus cyprinaceus sp. n. (COPEPODA: CYCLOPOIDA) FROM CYPRINID FISHES OF ALABAMA, WITH NOTES ON ITS BIOLOGY AND PATHOLOGY. J. Parasit., 55(2): 443-446.

Ergasilus cyprinaceus sp. n. is described from cyprinid fishes from a tributary of the Tallapoosa River System, Alabama. Notropis baileyi Suttkus and Raney was found to be infested on every collection date and was designated type host, but the parasite was observed to occasionally infest five additional species of cyprinids. A definite pathology of the gills was observed. Attempts to rear E. cyprinaceus from eggs were unsuccessful. Egg sac formation was observed to take place in the field at 62F. E. cyprinaceus appears to be most closely related to the E. caeruleus group. It lacks teeth on the second antennae, however, and has a large inflated portion projecting posteriorly from the second segment of the second antennae. (Auth.)

12611. Rogers, Wilmer A. (Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1968. EIGHT NEW SPECIES OF Gyrodactylus (MONOGENEA) FROM THE SOUTHEASTERN U. S. WITH REDESCRIPTIONS OF G. fairporti Van Cleave, 1921, AND G. cyprini Diarova, 1964. J. Parasit., 54(3): 490-495.

Nine new species of Gyrodactylus are described from the Southeastern U. S. as follows: G. alabamensis sp. n. from the Alabama chub, Nocomis leptocephalus bellicus Girard; G. albeoli sp. n. from the white shiner, Notropis albeolus Jordan; G. gloriosi sp. n. from the bluespotted sunfish, Enneacanthus gloriosus (Holbrook); G. illigatus sp. n. from the silverband shiner, Notropis shumardi (Girard); G. lingulatus sp. n. from the Alabama hogsucker, Hypentelium etowanum (Jordan); G. magniclypeus sp. n. from the black jumprock, Moxostoma cervinum (Cope); G. nannus sp. n. from the tidewater silverside, Menidia beryllina (Cope); and G. tennesseensis sp. n. from the southern redbelly dace, Chrosomus erythrogaster (Raf.). G. fairporti Van Cleave, 1921, from the speckled bullhead, Ictalurus nebulosus marmoratus (Holbrook) and G. cyprini Diarova, 1964, from the carp, Cyprinus carpio L. are redescribed. Host fish were collected from Alabama, Georgia, Tennessee, and Virginia. Type specimens were deposited in the USNM Helminthological Collection, Beltsville, Maryland. (Auth.)

12612. Avault, James W., Jr., and R. O. Smitherman (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1965. EXPERIMENTAL HOST SPECIFICITY OF Posthodiplostomum minimum. Exp. Parasit., 17(3): 268-270.

Parasite-free snails of the genus Physa were experimentally infected with the miracidia of Posthodiplostomum minimum, the metacercariae of which were originally obtained from bluegills, Lepomis macrochirus. Twelve species of fish representing 5 families (Cyprinidae, Cichlidae, Centrarchidae, Poeciliidae and Ictaluridae) were exposed to cercariae from the infected snails. Two sunfish hybrids (female green sunfish, Lepomis cyanellus X male redear sunfish, Lepomis microlophus; and female bluegill X male redear) were also exposed to cercariae of P. minimum. Only members of the family Centrarchidae became infected. Moreover, only the bluegill and its hybrid contained metacercariae in substantial numbers. (Authors)

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12613. Prosser, C. Ladd, William Mackay, and Kenneth Kato (Dept. of Physiol. and Biophysics, Univ. of Illinois, Urbana, Illinois). 1970. OSMOTIC AND IONIC CONCENTRATIONS IN SOME ALASKAN FISH AND GOLDFISH FROM DIFFERENT TEMPERATURES. Physiol. Zool., 43(2): 81-89.

The osmoconcentration of plasma of zoarcid and stichaeid fish taken from relatively deep water of uniformly low temperature is higher than that of fish from regions of higher and more fluctuating temperature. Osmotic differences are due mainly to sodium chloride in plasma; potassium concentration is correspondingly higher in muscle. Resting potentials in muscles of stichaeids and soles indicate similar relative permeabilities to ions. Goldfish acclimated to 5C have significantly lower plasma sodium and chloride concentrations and lower muscle potassium than when acclimated to 15 and 25C. It is suggested that the generally higher salt concentrations in marine fish at low temperatures and lower concentrations in fresh-water fish in the cold may be compensations toward reduced osmotic work, and that shifts in ion concentrations may be limited by membrane tolerances. (Authors summ.)

12614. Takei, Makoto, and Hidesaburo Itow. 1969. STUDIES ON FISHES' FAVORITE FOODS - III. ELECTRIC RESPONSE FROM OLFACTORY LOBUS TO FLAVOR SUBSTANCES IN CARP. Bull. Tokai Fish. Res. Lab., No. 57, pp. 63-69.

The effect of stimulation by flavor substances of electric activity from the olfactory lobus was observed so as to determine the preference of carp. Tubifex worms, mysis, and water fleas stimulated electric activity from the olfactory lobus. Stimulation was recorded from the olfactory lobus in response to acetic acid, butyric acid and morpholin, but olfactory response to the flavor substances tested was not recorded. (Authors)

12615. Onishi, Toshio, and Shigeo Murayama. 1969. STUDIES ON ENZYMES OF CULTIVATED SALMONOID FISHES - I. ACTIVITIES OF PROTEASE, AMYLASE, ARGINASE, GPT (GLUTAMIC-PYRUVIC TRANSAMINASE) AND GOT (GLUTAMIC-OXALOACETIC TRANSAMINASE). Bull. Tokai Fish. Res. Lab., No. 59, pp. 111-119. (In Japanese with English abstract).

Activities of enzymes in eight species of salmonids reared on a commercial diet for 22-23 months at Nikko Trout Hatchery were studied. The activity of protease in pyloric caeca was highest in brook trout. Cherry salmon and lake trout came next, but they were far lower than brook trout. The brown trout was lowest. The activity of stomach protease did not differ much by species. Comparing the activity of amylase on pyloric caeca, stomach, intestine and liver, the first one was found to be highest irrespective of the species of fish. Comparing the species by the amylase activity of the pyloric caeca, the rainbow trout including its albino form was found to be the highest of the eight species. Hepatic arginase differed considerably by sex. The mature male showed higher activity than the female and the immature one. It seemed that hepatic arginase is connected with increase of gonadal protamine with maturation. Fish of the genus Oncorhynchus showed higher activity than did those of Salmo and Salvelinus. The hepatic GPT activity was high in lake trout, Japanese char and brown trout. Hime salmon showed the lowest. The hepatic GOT activity did not differ much by species though lake trout was the highest and hime salmon the lowest. (Authors)

12616. Dragesund, Olav (Inst. of Mar. Res., Bergen, Norway). 1970. DISTRIBUTION, ABUNDANCE AND MORTALITY OF YOUNG AND ADOLESCENT NORWEGIAN SPRING SPAWNING HERRING (Clupea harengus Linné) IN RELATION TO SUBSEQUENT YEAR-CLASS STRENGTH. Fiskeridir. Skr. Havundersøk., 15(4): 451-556.

The distribution of young and adolescent herring in coastal and offshore waters of northern Norway has been investigated for the 1959-1965 year-classes by combined acoustic surveys and fishing experiments. (Auth. summ.)

12617. Dragesund, Olav (Inst. of Mar. Res., Bergen, Norway). 1970. FACTORS INFLUENCING YEAR-CLASS STRENGTH OF NORWEGIAN SPRING SPAWNING HERRING (Clupea harengus Linné). Fiskeridir. Skr. Havundersøk., 15(4): 381-450.

Variation in year-class strength of Norwegian spring spawning herring is analysed in relation to the structure and the size of the spawning stock, the location and the time of spawning and environmental conditions during the egg stage and the early larval development with special reference to the 1959-1965 year classes. (Auth. summ.)

12618. Naevdal, Gunnar (Inst. of Mar. Res., Bergen, Norway). 1970. FURTHER STUDIES ON BLOOD PROTEIN POLYMORPHISM IN SPRAT. Fiskeridir. Skr. Havundersøk., 15(5): 555-564.

About 3000 specimens comprising 29 samples of sprat have been analysed for hemoglobin and serum protein types. The samples were collected at different localities on the Norwegian coast, in Kattegat and the North Sea. The results of the samples from the coast confirm the results obtained by corresponding studies made before, i.e. great variations among samples, especially among samples from western Norway. The Kattegat samples coincided with part of the samples from western Norway, with most of the samples from the Skagerak coast and with one sample from the Oslo fjord. The samples from the North Sea also showed accordance with some of the samples from the Norwegian coast. The present and previous analyses indicate that the sprat population in Norwegian waters consists of one major component recruited from Kattegat and the North Sea, and minor components recruited from local spawning in the fjords. (Auth. summ.)

12619. Naevdal, Gunnar (Inst. of Mar. Res., Bergen, Norway). 1970. DISTRIBUTIONS OF MULTIPLE FORMS OF LACTATE DEHYDROGENASE, ASPARTATE AMINOTRANSFERASE AND SERUM ESTERASE IN HERRING FROM NORWEGIAN WATERS. Fiskeridir. Skr. Havundersøk., 15(5): 565-572.

By use of combined starch and agar gel electrophoresis 10 samples (1258 specimens) were studied for serum esterase polymorphism, 13 samples (1454 specimens) for lactate dehydrogenase (LDH) polymorphisms and one sample (100 specimens) for aspartate aminotransferase (AAT) polymorphism. The samples were collected in Norwegian waters and the North Sea. In two groups of esterase (weak and strong components) and in LDH and AAT intraspecific, hereditable variations were observed. Frequencies of LDH and AAT phenotypes were found to be similar to corresponding frequencies observed in samples from Canadian waters. Statistically significant variations among samples were observed in distributions of the phenotypes, especially the esterase phenotypes. (Auth. summ.)

12620. Naevdal, Gunnar (Inst. of Mar. Res., Bergen, Norway). 1970. STUDIES ON BLOOD PROTEINS OF MACKEREL. Fiskeridir. Skr. Havundersøk., 15(5): 573-582.

Fourteen samples of mackerel, about 1800 specimens, from the North Sea and the Norwegian Coast were analysed by agar gel electrophoresis (hemoglobins) and combined starch and agar gel electrophoresis (serum proteins and serum esterase). Hemoglobin variations related to ontogeny appeared during the first year of the mackerel's life. In mackerel one year and older normally one strong hemoglobin component occurred. Two strong components were observed in some specimens (probably heterozygotes) but too infrequently to be used for studies on population units. In the serum proteins were found extensive variations, but the greater part of the variations occurred in very weak bands, or the observed phenotypes were somewhat unstable. Normally one transferrin band was seen, but also a double band pattern (probably heterozygote) were observed although too infrequently to be used in studies of population units. Five esterase components could be clearly distinguished, and a few more were indicated. Each of the components seemed to be controlled by one gene in a series of polyalleles, although some samples showed a significant excess of observed homozygotes according to

this theory. No significant variations in gene frequencies between the samples were found. The results also were approximately in accordance with corresponding results from the southern North Sea and the areas south of the British Islands. (Auth. summ.)

12621. Chu, Chung Ling, and George N. Greene (Fish. Lab., Agric. Exp. Sta. Auburn Univ., Auburn, Alabama). 1967. EXPERIMENTS ON THE USE OF A BIOFILTER TO REMOVE WASTES FROM FISH TANKS. Proc. Twentieth Annual Conf. Southeastern Assoc. of Game and Fish Commissioners, pp. 446-457.

Circulation of the water from aquaria through a biofilter reduced the concentration of organic wastes from the feed and fish and increased the oxygen when compared with similar aquaria without filtration. The aquaria in which the water was changed twice daily contained the fewest wastes and the most oxygen. At the stocking rate used, fish died within 12 days in aquaria without filtration, but lived and grew well in aquaria with filtration and aquaria with water changes. When stocked at 280 g. per aquarium (equivalent to 13,450 lb. per acre) and fed at rates diminishing from 4.0 to 3.1 percent of the body weight per day, the fish grew an average of 1.1 percent per day. This growth was not significantly different from the growth in the aquaria with water changes. The mean conversion factor for the filtered groups was 4.1, and it was 3.7 for the water changes group. (Authors summ.)

12622. Prather, E. E. (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1965. EXPERIMENTS WITH WHITE CATFISH AS A SPORT FISH. Auburn Univ. Zoology-Entomology Dept. Series, Fisheries No. 2, 9 p.

The white catfish is more difficult to catch than channel catfish, but it provides good fishing. Although most fishermen agree that the white catfish tastes as good as the channel catfish, a majority prefer the latter since it bites better, fights harder, and gives about 5 percent higher dressed weight because of smaller head. The presence of white catfish in combination with channel catfish appears desirable and might extend the period of good fishing since they are less readily caught. While white catfish spawned in this combination of species, insufficient young escape predation to maintain good fishing for a long period when heavy fishing effort is exerted. (Auth. conclusions)

12623. Clark, Shirley, M., and George R. Snyder (Bur. of Comm. Fisheries, Biol. Lab., Seattle, Washington). 1970. LIMNOLOGICAL STUDY OF LOWER COLUMBIA RIVER, 1967-68. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Special Scientific Report - Fisheries No. 610, 14 p.

Limnological data were collected from late July 1967 through December 1968 at seven sampling stations from above the mouth of the Willamette River to below Puget Island. Items studied were: physical (water, temperature, turbidity, conductivity, and salinity), chemical (pH, dissolved oxygen, phosphate, silicate, calcium, magnesium, and sodium), and biological (chlorophyll a and zooplankton). Dissolved oxygen was lower in 1967-68 than it had been in previous studies in 1954-55 and 1960; water temperature was higher in 1967-68 than in the other two periods. (Authors)

12624. U. S. Department of the Interior, Bur. of Commercial Fisheries. 1970. ANADROMOUS FISH RESOURCES - SUPPLEMENT. U. S. Dept. of Interior, Bur. of Comm. Fish., 19 p.

This supplement covers the first 4 years of project activities under the Anadromous Fish Conservation Act of 1965, Public Law 89-304. It is intended to provide program coordinators and administrators, legislators, project personnel, and others interested in anadromous fish resources with details of individual projects and other pertinent information. (Introduction)

12625. Ross, Avron, J. (Western Fish Disease Lab., Sand Pt. Naval Air Sta., Seattle, Washington). 1970. VIBRIOSIS IN FISH. U. S. Dept. of Interior, Div. of Fishery Research, Fish Disease Leaflet No. 29, 3 p.

12626. Smith, Albert C. (Div. of Science, Univ. of Hawaii, Hilo, Hawaii). 1970. PERMEABILITY OF THE EYE LENS CAPSULE OF THE BIGEYE TUNA TO NUCLEAR EYE LENS PROTEINS. Comp. Biochem. Physiol., 34(1): 101-108.

Protein was extracted from lens nuclei of bigeye and skipjack tunas, dolphin fish and one species of squid. Total concentration and electrophoretic characteristics of the protein were determined in extracts which were not enclosed or were partially enclosed in bigeye lens capsule for 24 hr. High molecular weight proteins from all fish species, but none from the squid, filtered through pores in the lens capsule. These proteins, therefore, must be shaped similarly in the fishes but differently in the squid. The lens capsule appears effective as a molecular sieve for demonstrating distant, but not close, phylogenetic relationships. (Auth.)

12627. Lech, John J. (Dept. of Pharmacology, Marquette School of Medicine, Milwaukee, Wisconsin). 1970. GLYCEROL KINASE AND GLYCEROL UTILIZATION IN TROUT (Salmo gairdneri) LIVER. Comp. Biochem. Physiol., 34(1): 117-124.

Glycerol kinase (E. C. 2.7.1.30) was found in livers of rainbow trout (Salmo gairdneri). The enzyme has a pH optimum of 9.0 and appeared to be more stable at alkaline pH than rat liver glycerol kinase. Liver slices from rainbow trout were able to metabolize glycerol to CO_2, glycogen and lipids in vitro. In vivo studies at 12°C indicated that rainbow trout are able to metabolize significant amounts of glycerol. The findings are discussed with respect to glycerol arising from hydrolysis of endogenous triglycerides. (Auth.)

12628. Caldwell, Richard S., and F. John Vernberg (Duke Univ. Mar. Lab., Beaufort, North Carolina). 1970. THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE LIPID COMPOSITION OF FISH GILL MITOCHONDRIA. Comp. Biochem. Physiol., 34(1): 179-191.

The phospholipid fraction of goldfish gill mitochondria contained proportionately more cardiolipin and phosphatidyl ethanolamine and less sphingomyelin at 10°C than at 30°C but total phospholipid phosphorus levels remained unchanged. The total mitochondrial lipids from both goldfish and yellow bullhead gill tissues were more unsaturated at the colder acclimation temperatures. Generally, the levels of saturated and monounsaturated fatty acids were reduced and polyunsaturated fatty acids were increased in both species at the lower temperature. Changes in mitochondrial lipid composition presumably assist in maintaining a specific molecular organization over a wide range of environmental temperatures. (Auth.)

12629. Pandey, S., and John F. Leatherland (Dept. of Zoology, Univ. of British Columbia, Vancouver, Brit. Col., Canada). 1970. COMPARISON OF THE EFFECTS OF METHALLIBURE AND THIOUREA ON THE TESTIS, THYROID, AND ADENOHYPOPHYSIS OF THE ADULT AND JUVENILE GUPPY, Poecilia reticulata Peters. Canad. J. Zool., 48(3): 445-450.

Thiourea and methallibure are equally effective in completely blocking the initiation of spermatogenesis in juvenile guppies and also in inhibiting spermatogenesis in adults. Both compounds appear to act by blocking the activity of pituitary gonadotrophs which regress. Methallibure has antithyroid properties in adult guppies but has negligible effects in juveniles. On the other hand, the goitrogenic effects of thiourea are far more pronounced and affect both adults and juveniles. Whereas thiourea inhibits growth and causes an increase in granulation in the pituitary somatotrophs, methallibure causes a degranulation of the somatotrophs and a depression of the somatotroph cell index (in adults) and does not significantly affect the growth rate. (Authors)

12630. U. S. Department of the Interior, Bur. of Commercial Fisheries. 1970. ANADROMOUS FISH RESOURCES - THEIR CONSERVATION, DEVELOPMENT, ENHANCEMENT. U. S. Dept. of Interior, Bur. of Comm. Fisheries, 28 p., illus.

12631. Gray, R. W., and C. W. Andrews (Dept. of Biology, Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1970. SEX RATIO OF THE AMERICAN EEL (Anguilla rostrata, LeSueur) IN NEWFOUNDLAND WATERS. Canad. J. Zool., 48(3): 483-487.

The sex ratio of the American eel in Newfoundland was estimated from studies of 354 samples from two brackish water and three freshwater habitats in Newfoundland. Sections of each gonad were cut at 10 μ, stained with haematoxylin, and counterstained with eosin. The material was divided into four classes; namely, females, immature females, males, and undifferentiated eels. Females were found in both brackish water and freshwater areas, while only one male was present in the material. The state of maturity of silver eels leaving Topsail Pond in the fall was determined from ova diameters. Ova diameters ranged from 0.109 to 0.214 mm; the average was 0.165 mm. These results agree closely with those reported by Svardson for migrating silver eels in Europe. (Authors)

12632. Ogawa, Mizuho (Dept. of Biology, Saitama Univ., Urawa, Saitama, Japan). 1970. EFFECTS OF PROLACTIN ON THE EPIDERMAL MUCOUS CELLS OF THE GOLDFISH, Carassius auratus L. Canad. J. Zool., 48(3): 501-503.

In hypophysectomized goldfish, prolactin injections caused an increase in both number and size of the epidermal mucous cells. In contrast, the effects of prolactin injections in intact fish varied seasonally; in summer the growth and new formation of mucous cells were slightly inhibited; in the late autumn, however, the mucous cells of prolactin-injected intact goldfish increased slightly in size but there was no significant change in cell number. The action of prolactin on the mucous cells of goldfish has been discussed and the possibility of a seasonal variation of prolactin secretion considered. (Auth.)

12633. Jackson, D. A., J. M. Anderson, and D. R. Gardner (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick and Dept. of Biol., Carleton Univ., Ottawa, Canada. 1970. FURTHER INVESTIGATIONS OF THE EFFECT OF DDT ON LEARNING IN FISH. Canad. J. Zool., 48(3): 577-580.

Alteration of previous training procedures for avoidance conditioning of salmonids indicated that, under appropriate conditions, fish were able to acquire a conditioned avoidance response when pretreated with sublethal doses of DDT. (Authors)

12634. Deelder, C. L., and F. W. Tesch (Rijkinstituut voor Visserijonderzoek: IJmuiden, The Netherlands). 1970. HOMING ABILITIES OF EELS (Anguilla anguilla), WHICH HAD BEEN TRANSPLANTED OVER LONG DISTANCES. Marine Biology, 6(1): 81-92.

Homing has been studied in 2,828 tagged eels Anguilla anguilla (L.) which had been transplanted in 1968 and 1969 over distances up to 253 km off the coasts of Germany and the Netherlands. Of the tagged specimens, an average of 9.9% were recaptured in 1968 and 2.9% in 1969. Recapture percentages were highest (up to 20%, depending upon the intensity of fyke net fishery) near the coast, especially along the IJsselmeer Dike. The return percentages of 2 types of tags (small plastic discs with perlon thread and flexible plastic arrows) gave similar results. Forty days after transplantation, recapture values decreased markedly, probably due to tag loss. The homing tendency decreased at displacement distances exceeding 133 km. However, even over such long distances, a fair number of eels were still recaptured on routes pointing towards the home area. Single eels returned to their home area over a range of more than 200 km. Straying eels have been recaptured within shorter distances from the releasing point. The period of time between release and recapture was shorter with straying than with homing individuals. These investigations confirm that homing of eels is possible not only in North-South, but also in West-East or East-West directions. The long distance (East-West) homing certainly excludes olfactory orientation because of the North-East flowing residual current of the southern North Sea. (Authors)

12635. Oliva, Ota, and Vlastislav Skorepa (Zoological Inst. of Charles Univ., Lab. of Ichthyology, Praha, Czechoslovakia). 1969. THE MYODOME IN SOME TELEOSTS. Vestn. csl. Spol. zool., 33(4): 337-350.

In 7 teleosts, namely Ctenopharyngodon idella, Hypophthalmichthys molitrix, Ophiocephalus argus, Trigla lucerna, Uranoscopus scaber, Trichiurus lepturus and Scorpaena porcus eye muscle topography and myodomes were studied and their detailed description is presented. In two Cyprinids, Ctenopharyngodon, Hypophthalmichthys and then in Trichiurus and Trigla both myodomes, especially posterior ones, are well developed. Ophiocephalus possesses comparatively short myodomes, in Uranoscopus myodomes are lacking. In Scorpaena there is a short anterior, but a long posterior myodome. (Authors)

12636. Tsai, S. C., and T. L. Huang (Rockefeller Foundation Fish Cult. Res. Program). 1969. CONTROL OF CHIRONOMID LARVAE IN MILKFISH PONDS WITH ABATE 50%E. C.. Reports of Fish Culture Res. supported by Rockefeller Foundation, Chinese-American Joint Comm. on Rural Reconstruction, Fish. Series No. 8, 118-122. (In Chinese - tables and summ. in English); Commercial Fish. Abstracts 23(8): p. 24.

Abate 50% E. C. (0, 0, 0', 0'-tetramethyl 0, 0'-thiodi-p-phenylene phosphorothioate), when diluted 2, 000 times with water and applied to milkfish ponds in an amount to make a concentration of 0. 05 p. p. m., will kill all chronomid larvae within a radius of 10 m. without adversely affecting the milkfish or the bottom algae. The author therefore suggests that this pesticide be used instead of Sumithion (0, 0-dimethyl 0-(3-methyl 4-nitrophenyl) phosphorothioate) or Lebaycid (0, 0-dimethyl 0-(4-methylmercapto-3-methylphenyl) thionophosphate) to control chironomid larvae in milkfish ponds. Tables are given showing the toxicity of Abate 50% E. C. under different water, dosage, and application conditions to chironomid larvae; of Abate 50% E. C. and Abate 1% granule on the algae in the pond; of Abate 50% E. C. on 13 species of fish and shellfish; and comparatively, of Abate 50% E. C. and 1% granule, Lebaycid 50% E. C., and Sumithion 50% E. C. to milkfish and chironomidae.

12637. Lin, Yao-sung (National Taiwan Univ., Taiwan, Formosa). 1970. THE EFFECT OF PHOSPHORUS AND NITROGEN FERTILIZERS ON FISH PRODUCTION IN FRESHWATER PONDS. Reports of Fish Cult. Res. supported by Rockefeller Foundation, Chinese-American Joint Comm. on Rural Reconstruction, Fish. Series, No. 9, 54-57 (In Chinese with English summ.); Commercial Fish. Abstracts, 23(8): p. 24.

Experiments were conducted to find out whether the production of Chinese carp could be increased (1) by intensifying the dosages of superphosphate or (2) by adding nitrogen fertilizers to the ponds. The results show that phosphorus fertilizer appreciably improves production, especially of silver carp. At a rate of 2, 000 kg/ha., $CaH_4(PO_4)_2$ gave the best results; $(NH_4)_2SO_4$ had no effect.

12638. Tibbo, S. N. (Fish. Res. Bd. Canada, St. Andrews, New Brunswick, Canada). 1970. HERRING - THE 'GOLDEN GOOSE' OF THE SEA. Fish. Res. Bd. Canada Biol. Sta., St. Andrews, N. B., General Series Circular No. 55, 5 p.

The recent rate of increase in Northwest Atlantic herring landings cannot continue indefinitely, and even now we may be in the danger area. The present expansion tendencies should not be allowed to continue unchecked. Industry as well as management, both nationally and internationally, might be well advised to adopt a policy of consolidating the present position before making plans for the future.

12639. Uchida, Richard N. (Bur. of Comm Fish. Biol. Lab., Honolulu, Hawaii). 1970. DISTRIBUTION OF FISHING EFFORT AND CATCHES OF SKIPJACK TUNA, Katsuwonus pelamis, IN HAWAIIAN WATERS, BY QUARTERS OF THE YEAR, 1948-65. U. S. Dept. of Interior, Bur. of Comm. Fish., U. S. Fish Wildl. Serv. Special Scientific Report - Fisheries No. 615, 37 p.

The temporal and spatial distribution of fishing effort and skipjack tuna catches

are described on the basis of detailed data on catch, location, and effort obtained each year from all vessels that fish full time for skipjack tuna in Hawaiian waters. Summarized are the amount of "effective" fishing (defined as a trip on which skipjack tuna were caught), the resulting catch, and catch per standard effective trip in each statistical area and combinations of statistical areas (regions). The fishing is highly seasonal. Usually the effort expended and the catch in the first quarter were 15 and 9 percent, respectively, of their annual totals. Fishing intensified in May and second quarter catches, produced by 32 percent of the annual effort, accounted for 33 percent of the annual catch. A further increase in effort to 36 percent of the annual total in the third quarter increased catches sharply so that they constituted 46 percent of the annual take. As the abundance of skipjack tuna declined in the fall, fishing also declined; fourth quarter effort, which was reduced to 17 percent of the annual total, produced only 12 percent of the annual catch. (Auth.)

12640. Greene, George N. (Auburn Univ., Agric. Exp. Sta., Auburn, Alabama). 1966. A REPRODUCTION CONTROL FACTOR IN THE CYPRINID FISH, Brachydanio rerio. Reprint from Proc. of the World Symposium on Warm-Water Pond Fish Cult., Rome, Italy, May 18-25, 1966; FAO Fish. Report 44, Vol. 4, IV/E-1, pp. 86-92, 1968.

A reproduction control factor is a possible solution to fish population regulation in ponds. A factor which significantly reduced spawning of Brachydanio rerio was found in water conditioned by B. rerio for 60 days or more at a stocking rate of 26.9 g in 40 l. This stocking rate is equivalent to 31 kg/are in a pond 0.5 m deep. It was not found in water with stocking rates up to 20 g of fish in 40 l, or in water conditioned for up to 47 days by 30 g of fish in 40 l. The factor apparently affects spawning activity rather than maturation of gametes. Chemical analyses indicated a possible relationship between high concentrations of ammonia and carbon dioxide and reduced spawning. (Auth.)

12641. Jones, Ralph R. (Auburn Univ. Agricultural Exp. Sta., Auburn, Alabama). 1966. AN OPTICAL METHOD FOR THE ESTIMATION OF THE STANDING-CROP OF PLANKTON IN PONDS AND LAKES. Reprint from Proc. of the World Symposium on Warm-Water Pond Fish Cult., Rome, Italy, May 18-25, 1966; FAO Fisheries Report 44, Vol. 4: VI/E-2, pp. 480-486.

Initial nephlometric measurements of plankton density in individual samples were compared with dry weights of plankton concentrated from samples by centrifuging to determine if a direct relationship existed between the two methods of measuring the standing-crop of plankton. A definite linear relationship was found to exist between dry weights and initial nephlos measurements. It was concluded that the nephlometric technique may be used to reliably measure the standing-crop of plankton in fresh-water impoundments. (Auth.)

12642. Bates, Daniel W., and John G. Vanderwalker (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1970. TRAVELING SCREENS FOR COLLECTION OF JUVENILE SALMON (MODELS I AND II). U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Special Scientific Report - Fisheries No. 608, 5 p., illus.

Two horizontal traveling screens were designed and operated for 2 years at the Carson National Fish Hatchery, Carson, Wash. Deflection efficiencies were 100 percent in 37 tests of over 11,000 juvenile coho, Oncorhynchus kisutch, and chinook salmon, O. tshawytscha. The screens demonstrated their potential capacity to divert young salmon moving downstream. (Authors)

12643. Coble, Daniel W. (Missouri Coop. Fish. Unit., Univ. of Missouri, Columbia, Missouri). 1970. VULNERABILITY OF FATHEAD MINNOWS INFECTED WITH YELLOW GRUB TO LARGEMOUTH BASS PREDATION. J. Parasit., 56(2): 395-396.

Tank experiments provided no evidence that yellow grub parasitism increases vulnerability of fathead minnows to largemouth bass predation. (Auth.)

12644. Bates, Daniel W., Ernest W. Murphey, and Earl F. Prentice (Eur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1970. DESIGN AND OPERATION OF A CANTILEVERED TRAVELING FISH SCREEN (MODEL V). U. S. Dept. of Interior, U. S. Fish Wildl. Serv., Special Scientific Report - Fisheries No. 608, pp. 6-15, illus.

Model V was installed within the Stanfield Irrigation Canal near Echo, Oregon. The Bureau of Commercial Fisheries developed the screen to meet the need for improved guiding of juvenile fish of all sizes and to reduce capital and operational costs. Field tests with the model V screen showed a head loss of only 9.1 mm. with waterflow of 73 centimeters per second. From 97 to 100 percent of the juvenile migrant coho salmon, Oncorhynchus kisutch, and steelhead trout, Salmo gairdneri, that entered the Stanfield Irrigation Canal were diverted into a bypass. The self-cleaning screen, supported by a wire-rope suspension system, traverses the 8.5-m. wide, 1.8 m. deep, earth-lined section of the canal at a 20° angle to the waterflow. Torsion induced in the structure by water forces on the screen is resisted by a main torque tube with track support arms placed at intervals along the tube. The support arms are tied with wire rope to anchors on shore. To minimize drag, the speed of the screen in the water can be matched to water velocity and the screen returned upstream above the water. Screen panels are cantilevered from carriers on a continuous track. (Authors)

12645. Dendy, J. S., V. Varikul, K. Sumawidjaja, and M. Potaros (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama). 1966. PRODUCTIONS OF Tilapia mossambica Peters, PLANKTON AND BENTHOS AS PARAMETERS FOR EVALUATING NITROGEN IN POND FERTILIZERS. Reprint from Proc. of FAO World Symposium on Warm-Water Pond Fish Cult., Rome, Italy, May 18-25, 1966; FAO Fish Report (44), Vol. III.

Twelve 0.1 ha earth ponds were used for this study. Four ponds received no fertilization, 0-0-0 (N-P-K), four received non-nitrogenous 0-8-2 (N-P-K) fertilization, and four received nitrogenous 8-8-2 (N-P-K) fertilization, the same fertilizer treatments which had been applied for the previous five years. Rates of stocking for each fertilizer treatment were 4,942; 9,884; 14,826 and 19,768 fish per ha. The duration of the experiment was from July to October 13-14. Increases in weights of fish per kg were determined upon draining of ponds. Unfertilized ponds produced an average of 242.6 kg per ha. The minimum and maximum rates of stocking resulted in production of 225.9 and 284.7 kg per ha, respectively. The two fertilizer treatments resulted in productions that were essentially alike. In fertilized ponds the average productions with increase in rates of stocking were 342.0, 695.3, 760.1, and 836.7 kg per ha, respectively. The study included rates of growth and reproduction of fish; abundance of plankton, including a volumetric analysis; and abundance of benthos. Results indicated increase in production with increase in rates of stocking and from 63 to 199 percent greater production in fertilized ponds than in unfertilized ponds. However, the elimination of nitrogen from fertilizer for six years did not result in a decline in fish production when water temperature remained above 22°C. (Authors)

12646. Meyers, T. U., J. Scala, and Evelyn Simmons (Fundamental Res., Owens-Illinois, Inc., Tech. Center, Toledo, Ohio). 1970. MODES OF TRANSMISSION OF WHIRLING DISEASE OF TROUT. Nature, 227(5258): 622-623.

Great blue herons (Ardea herodias) were fed fish infected with whirling disease. Light microscopy revealed that the spore phase of the parasite had passed through the digestive tract of the bird, apparently unaltered. Viable spores extrude their filaments when in alkaline conditions (pH 10-12), and so spores within the heron faeces were placed in 2 percent KOH and the polar filaments were extruded. Although extrusion is not conclusive evidence of viability, it supports that assumption. These results suggest that avian vectors of transmission should be considered for myxosporidian diseases. (Authors)

12647. Umminger, Bruce L. (Dept. of Biol., Yale Univ., New Haven, Conn.). 1970. OSMOREGULATION BY THE KILLIFISH, Fundulus heteroclitus, IN FRESH WATER AT TEMPERATURES NEAR FREEZING. Nature, 225(5229): 294-295.

Data are presented which indicate that ionic regulation is impaired in killifish adapted to freshwater when they are held at temperatures near freezing: concentrations of sodium and chloride in the serum are reduced. These data are especially convincing in view of the previous report in which the concentrations of these electrolytes increased in the serum of killifish adapted to saltwater and kept in the cold. (Auth.)

12648. Stott, B., and T. O. Robson (Salmon and Freshwater Fish. Lab., Min. of Agric., Fisheries and Food, Whitehall Place, London, England). 1970. EFFICIENCY OF GRASS CARP (Ctenopharyngodon idella Val.) IN CONTROLLING SUBMERGED WATER WEEDS. Nature, 226(5248): p. 870.

In the summer of 1969 at a site where the daily mean water temperature was 15.8° with a range of 8.5° to 21.5°C, and with plants which are readily eaten, a stocking density giving a mid-season biomass of approximately 300 kg of 2 year old grass carp per hectare reduced plant growth to about 50 percent of its potential. In the conditions of the experiment this mid-season biomass would, it is estimated, have required an initial stocking rate of 343 kg/hectare. (Authors)

12649. Mawdesly-Thomas, Lionel E., and David H. Barry (Dept. of Pathology, Huntingdon Res. Centre, Huntingdon, England). 1970. ACID AND ALKALINE PHOSPHATASE ACTIVITY IN THE LIVER OF BROWN AND RAINBOW TROUT. Nature, 227(5259): 738-739.

The activity of alkaline phosphatase was greater in the brown than in the rainbow trout, while acid phosphatase was more active in the rainbow than in the brown trout. The metabolic differences in these two species may begin to explain the inverse response to the induction of liver cell tumours. (Authors).

12650. Tesch, F. W. (Biologische Anstalt Helgoland (Zentrale); Hamburg, Germany). 1970. HOMING CAPACITY OF EELS Anguilla anguilla AFTER OBSTRUCTION OF THE OLFACTORY SENSE, AFTER ADAPTATION OR AFTER TRANSPLANTATION INTO A NEIGHBOURING ESTUARY. Marine Biology, 6(2): 148-157.

Homing has been studied in 1,057 tagged eels Anguilla anguilla L. In a number of these eels the olfactory sense was obstructed by means of plugs inserted into all olfactory orifices. After transplantation over a distance of about 8 km, 12% of the 1968 released eels and 3% of the 1967 liberated specimens were recaptured. More than 80% of these eels homed, and no significant difference occurred between normal eels and those with obstructed olfactory systems. Similar homing results, with a lower recapture rate of 2.6%, were observed in eels transplanted over a distance of about 70 km. As a control, eels were released within the original area of capture, and they did not leave their home district; of these 12.1% of olfactorily impaired specimens and 22.2% of untreated eels were recaptured when fyke nets prepared with bait were used; however, when fyke nets without bait were used, 14.9% impaired, and 17.0% untreated, eels were recaptured. This result suggests the eel's dependence upon its olfactory sense in its search for food. In a further experiment, 105 eels were transplanted over a distance of about 70 km from salinities of about 15 ‰ to more than 30 ‰, and allowed to adapt for a period of 4 weeks; 3 specimens homed. This fact probably indicates that, provided the adaptation time is long enough, eels do not use salinity or other environmental factors (e.g. temperature or light) of their home area as orientation clues. (From Auth.)

12651. Wellborn, Thomas L., Jr., and Wilmer A. Rogers (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1966. A KEY TO THE COMMON PARASITIC PROTOZOANS OF NORTH AMERICAN FISHES. Auburn Univ. Zoology-Entomology Dept. Series - Fisheries No. 4, March 1966, revised June 1970, 17 p., illus.

12652. Scheil, H.-G. (Zoolog. Inst. der Univ. Kiel (Lehrstuhl fur vergl. Phsiol. und Tierpsychol.); Kiel, Germany). 1970. CONTRIBUTIONS TO THE TEMPERATURE ADAPTATION OF THE EEL Anguilla anguilla. IV. INFLUENCE OF ADAPTATION TEMPERATURE ON THE DENERVATED LATERAL MUSCLE. Marine Biology, 6(2): 158-166.

In order to discover whether the spinal cord plays a role in muscular temperature adaptation, the responses of spinalectomized and intact eels Anguilla anguilla L. were compared. Eight and 14 days after denervation, the activities of the succinate oxidase-system and of cytochromoxidase were examined in 4 groups of eels (adapted to 14° or 24°C before and after operation; adapted to 14°C before and to 24°C after operation; or vice versa). Only the 24°C eels show significant differences which refer to the second phase of atrophy according to Muscatello et al. (1965). All differences measured at the various adaptation temperatures can be explained as adaptation effects allowing for the consequences of the operation (atrophy) on the denervated individuals. Therefore, a significant influence of the spinal cord on temperature adaptation of the lateral muscle of the eel is improbable. (Auth.)

12653. Rosenthal, H., and R. Stelzer (Biologische Anstalt Helgoland (Zentrale); Hamburg, Germany). 1970. EFFECTS OF 2, 4- AND 2, 5-DINITROPHENOL ON THE EMBRYOLOGICAL DEVELOPMENT OF THE HERRING Clupea harengus. Marine Biology, 5(4): 325-336.

The biological effects of dinitrophenol (DNP) were tested on Clupea harengus eggs of Baltic spring and autumn spawners. Experimental water temperature was maintained at 10.8°C ± 0.2C° (experiment 1) and 11.8°C ± 0.2C° (experiments 2 and 3); salinity ranged between 14 and 16 °/oo. Eggs were artificially fertilized 1 to 4 h after catching the parent individuals; they were attached to glass plates and incubated in 1 l aerated containers. Thirty, 48 and 55 h after fertilization, eggs were transferred to various test concentrations of DNP. 2, 4-Dinitrophenol is known as a true uncoupling reagent, which inhibits the phosphorylation of ADP. The effects of DNP on embryo activity, heart rate, rates of body malformations and mortality are studied. Embryo activity rose above control values between the 6th and 7th days of the incubation period in low DNP concentrations (0.01 to 0.05 m M/l), and heart activity deviated after 5 to 7 days from that of the controls. Mortality rate depended on inhibitor concentration and time of poisoning. Various malformations of embryos were observed (anophthalmy, symmetrical and unilateral microphthalmy, curled bodies, de-differentiations). (Authors)

12654. Lasker, R., H. M. Feder, G. H. Theilacker, and R. C. May (Bur. of Comm. Fish., Fishery-Oceanography Center, LaJolla, California). 1970. FEEDING, GROWTH, AND SURVIVAL OF Engraulis mordax LARVAE REARED IN THE LABORATORY. Marine Biology, 5(4): 345-353.

Methods are described for the successful rearing of northern anchovy larvae (Engraulis mordax Girard) on cultured foods. Larvae were fed successively on the unarmored dinoflagellate Gymnodinium splendens, the veliger of the gastropod Bulla gouldiana, and nauplii of the brine shrimp Artemia salina. Rearing containers ranging in capacity from 4.5 to 510 l were tested; the smaller ones were found to be most useful for laboratory experimentation. Irreversible starvation occurred when E. mordax were denied food for more than 1.5 days after yolk absorption. Growth rates of larval anchovies fed different diets were compared. Larvae fed G. splendens grew for 1 week at the same rate as animals fed wild plankton, but did not maintain this rate. Laboratory survival of E. mordax larvae on a diet of G. splendens alone, did not differ significantly when veligers supplemented the diet. However, when G. splendens and veligers were fed simultaneously to E. mordax larvae, growth rate was greatly improved, although still not matching the growth attained on a diet of wild plankton. Length (L) versus weight (W) analyses were made for all larvae at all diets. The results showed that weight could be calculated most accurately from length by the relationship log W = 3.3237 log L − 3.8205, regardless of diet. (Authors)

12655. Houde, E. D., and B. J. Palko (Bur. of Comm. Fish. Tropical Atlantic Biol. Lab., Miami, Florida). 1970. LABORATORY REARING OF THE CLUPEID FISH Harengula pensacolae FROM FERTILIZED EGGS. Marine Biology, 5(4): 354-358.

Pelagic eggs of the scaled sardine Harengula pensacolae (Goode and Bean), have been hatched and reared in the laboratory for the first time. Larvae were reared in two 75 l aquaria under constant illumination, at an average temperature of 26.2°C. Zooplankton collected in a 35μ mesh net was fed to the newly hatched larvae, and the diet was supplemented later with Artemia salina nauplii and a pelleted food. Larvae hatched at 4 mm TL (total length), and metamorphosed about 25 days later at 25 to 30 mm TL. Survivors averaged 76 mm TL 100 days after hatching. Of the 500 incubated eggs, 2.8% survived until 20 days, after which no significant natural mortality occurred. Sources of natural mortality included starvation, a copepod parasite (Caligus sp.), and injuries from contact with the sides of the tank. Larvae began feeding at 4.5 mm TL on copepod nauplii averaging 62μ in body width. Scaled sardines were photopositive throughout the larval stage. (Authors)

12656. Dahlberg, Michael D., and Eugene P. Odum (Marine Inst. and Zoology Dept., Univ. of Georgia, Sapelo Island, Georgia). 1970. ANNUAL CYCLES OF SPECIES OCCURRENCE, ABUNDANCE, AND DIVERSITY IN GEORGIA ESTUARINE FISH POPULATIONS. Amer. Midl. Nat., 83(2): 382-392.

A total of 31,637 individuals comprising 70 fish species and 37 families, were trawled in a Georgia estuary. Population structure was influenced by seasonal changes in taxa, numbers of species and individuals, and average size of fishes. Species - numbers diversity was studied in regard to seasonal variation and three zones. Four indices were compared. Seasonal variation was found with "equitability" and "evenness" but not with the Shannon-Wiener index of species "richness". A seasonal change in relative abundance resulted primarily from the influx of juveniles in the late summer and autumn. An apparent increase in diversity from sounds to small creeks based on three indices was not statistically significant. (Authors)

12657. Li, M. F., and G. S. Traxler (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1970. OBSERVATIONS ON RAINBOW TROUT OVARY CELLS INFECTED WITH AMPHIBIAN VIRUS (LT-1). Canad. J. Microbiol., 16(7): 642-645.

The amphibian virus, LT-1, produced relatively irregular necrotic areas in the monolayer of rainbow trout ovarian cells. The infected cells underwent the following cytopathic changes: extensive cytoplasmic vacuolation, formation of multiple nuclei, and paranuclear cytoplasmic inclusions. The site of replication of the virus in the infected rainbow trout ovarian cells was demonstrated to be located at the less electron-dense areas of the cytoplasm and surrounded by numerous vacuoles. A comparison of the susceptibility to LT-1 virus of rainbow trout ovarian cells with that of fathead minnow cells resulted in a calculated cytopathic index of 4.48. (Authors)

12658. Walter, Roger O., and James B. Hamilton (Dept. of Anatomy, State Univ. of New York College of Medicine, N.Y.C., Brooklyn, New York). 1970. SUPER-MALES (YY SEX CHROMOSOMES) AND ANDROGEN-TREATED XY MALES: COMPETITION FOR MATING WITH FEMALE KILLIFISH Oryzias latipes. Anim. Behav., 18(1): 128-131.

In daily competitions for mating, between matched pairs of males (one YY and one XY), the YY genotype was usually the victor and had higher mean values for individual components of male reproductive behaviour. After 183 tests of competition between pairs of untreated YY and XY males, with spawnings in 114 of these trials, tests were continued while the losing XY males were given testosterone propionate. During androgenic treatment the XY males induced more spawnings than YY males, i.e. became victors instead of losers. Also, while XY (but not YY) males received exogenous androgen, the XY males tended to score higher

mean values for all but one of the components of male reproductive behaviour under study, whereas YY males tended to have reduced values. Data for individual pairs of fish were consistent with mean data for all pairs. (Authors summ.)

12659. Houston, A. H., J. A. Madden and M. A. DeWilde (Dept. of Biol., Marquette Univ., Milwaukee, Wisconsin). 1970. ENVIRONMENTAL TEMPERATURE AND THE BODY FLUID SYSTEM OF THE FRESH-WATER TELEOST – IV. WATER-ELECTROLYTE REGULATION IN THERMALLY ACCLIMATED CARP, Cyprinus carpio. Comp. Biochem. Physiol., 34(4): 805-818.

Carp have marked ability to regulate body fluid electrolytes over a wide range of temperatures. There was a seasonal variation in plasma ions; factors other than ions, amino acids or protein may be involved in cold-acclimated animals. The muscle water content was thermostable. The concentration of Cl^-, Ca^{2+} and Mg^{2+} were relatively stable, while Na^+ and K^+ varied seasonally and with temperature. Electrolyte changes which occur during temperature acclimation may contribute to accompanying alterations in intermediary metabolism. (Authors)

12660. Moore, Richard H. (Univ. of Texas Mar. Sci. Inst., Port Aransas, Texas). 1970. CHANGES IN THE COMPOSITION OF THE SWIMBLADDER GAS OF THE STRIPED MULLET, Mugil cephalus, DURING HYPOXIA. Comp. Biochem. Physiol., 34(4): 895-899.

Changes in the gas composition of the swimbladder of the striped mullet, Mugil cephalus, were measured by gas chromatographic analysis of 1-ml samples. During hypoxia the oxygen content of the swimbladder decreased to a level proportional to the dissolved oxygen content of the surrounding water. Since such a small amount of oxygen is involved, and since reabsorption takes place over a 1-hr period, it is doubtful if this oxygen plays an important role in respiration. (Auth.)

12661. Sarphie, T. G., and G. Crozier (Dept. of Path., Univ. of Mississippi Medical Center, Jackson, Mississippi). 1970. CAROTENOIDS OF THE CENTRARCHIDAE. Comp. Biochem. Physiol., 34(4): 963-965.

The carotenoid found in the skin and fins of eleven species of Centrarchids was identified as lutein, in the esterified form. Of the five genera, Lepomis generally has higher concentrations of pigment. Astaxanthin appears in the fins and skin of Lepomis megalotis during the breeding season. (Authors)

12662. McCabe, Mead M., and David M. Dean (Lab. for Quantitative Biol., Dept. of Biol., Univ. of Miami, Coral Gables, Florida). 1970. ESTERASE POLYMORPHISMS IN THE SKIPJACK TUNA, Katsuwonus pelamis. Comp. Biochem. Physiol., 34(3): 671-681.

Five groups of esterases, identified by their migration rates, substrate specificities and inhibitor sensitivities, were resolved by starch gel electrophoresis. Electrophoretic variations of three esterases are described and genetic schemes are proposed to explain the variations of two of them. Esterase III is assumed to be a dimer. A single locus (e-III) with four alleles is proposed to account for the four observed phenotypes. Each isoenzyme of esterase Ib appears to be either a monomer, or a polymer of the same sub-unit. A single locus (e-Ib) with seven alleles, one of them a null allele, is proposed to explain the observed variations. (Authors)

12663. Poluhowich, John J. (Regulatory Biol. Section, Biol. Sci. Group and Inst. of Cellular Biol., Univ. of Conn., Storrs, Connecticut). 1970. AN ELECTROPHORETIC COMPARISON OF HEMOGLOBINS FROM AMERICAN AND EUROPEAN EELS. Comp. Biochem. Physiol., 34(3): 739-743.

Hemoglobins from the American (Anguilla rostrata) and European (Anguilla anguilla) eels were compared electrophoretically. In continuous and discontinuous starch-gel systems, hemoglobins from both species produced identical patterns. A single variant pattern was observed in the electrophoretic pattern of the American species. (Auth.)

12664. McCabe, Mead M., David M. Dean, and Craig S. Olson (Lab. for Quant. Biol., Dept. of Biol., Univ of Miami, Coral Gables, Florida). 1970. MULTIPLE FORMS OF 6-PHOSPHOGLUCONATE DEHYDROGENASE AND ALPHA-GLYCEROPHOSPHATE DEHYDROGENASE IN THE SKIPJACK TUNA, Katsuwonus pelamis. Comp. Biochem. Physiol., 34(3): 755-757.

Electrophoretic variations of 6-phosphogluconate dehydrogenase (6-PGD) in Katsuwonus pelamis appear to result from allelic differences at a single locus, pgd. The electrophoretic patterns of alpha-glycerophosphate dehydrogenase (GPD) appear to be influenced by both allelic differences at a single locus, gpd, and the consistent occurrence of artefact bands. These two enzymes may not be genetically polymorphic. (Authors)

12665. Laflin, Bonny Dale. 1970. SOME EFFECTS OF MUNICIPAL SEWAGE POLLUTION UPON THE BIOTA AND WATER QUALITY OF ELKHORN CREEK. Dept. of Fish and Wildl. Resources, Kentucky Fisheries Bull. No. 55.

Investigations were conducted on Elkhorn Creek to document the effect Lexington's sewage effluents are having on water quality, bottom fauna and fish populations of the South Fork and to a lesser degree Main Elkhorn Creek. A dissolved oxygen concentration below Town Branch, the source of pollution on the South Fork, of less than 2.6 ppm from June through November was revealed with a low of 0.4 ppm occurring in November. The mean Biochemical Oxygen Demand (BOD) was 12.8 ppm with a monthly high of 30.0 ppm. Free carbon dioxide with a mean of 7.5 ppm was also higher than at any other location. In contrast the dissolved oxygen on the North Fork remained above 5.0 ppm, except for one month (4.6 ppm), and the mean BOD was only 3.7 ppm. Below the mouth of Town Branch, the bottom fauna is composed almost entirely of sewage worms. There was an average of 643 per sample in the polluted area. The fish population of the polluted area of the South Fork was composed of only 84 fish (4.7 pounds) per acre. The Main Creek contained 164 fish (91 pounds) but the North Fork contained the largest population with 792 fish per acre (78 pounds). Smallmouth bass and largemouth bass were common in the Main Creek and the North Fork while they were all but absent in the South Fork. (From auth.)

12666. Fish, G. R., and M. A. Chapman (Fish. Res. Div., Mar. Dept., Rotorua, New Zealand). 1969.. SYNOPTIC SURVEYS OF LAKES ROTORUA AND ROTOITI. N. Z. J. Mar. and Freshw. Res., 3(4): 571-584, Fish. Res. Publ. No. 136.

Surface and bottom water samples were collected from 39 widely spaced stations in Lake Rotorua in February 1967 and from 12 stations in Lake Rotoiti in March 1967. In Lake Rotorua, data obtained from these samples showed that small horizontal differences existed between the southern and northern parts of the lake probably related to the higher inflow of plant nutrients at the southern end and to the prevailing southerly wind concentrating phytoplankton populations at the northern end. Lake Rotoiti, which differed from Lake Rotorua in being thermally stratified, showed no important horizontal differences, vigorous mixing in the strata probably being accomplished by deep seiches except in the shallow western basin of the lake, where the inflow from Lake Rotorua occurs. Serial vertical hauls for a zooplankton survey of Lake Rotoiti were taken from three stations in March 1967. The distribution of zooplankton was complex because diurnal vertical migrations of the animals were combined with horizontal movement of the water layers. (Authors summ.)

12667. Martin, F. Douglas (Dept. of Zool., Indiana Univ., Bloomington, Indiana). 1970. FEEDING HABITS OF Cyprinodon variegatus (CYPRINODONTIDAE) FROM THE TEXAS COAST. The Southwestern Naturalist, 14(3): 368-369.

12668. Marshall, K. E., and J. J. Keleher (Fish. Res. Bd. Canada). 1970. A BIBLIOGRAPHY OF THE LAKE TROUT, Cristivomer namaycush (Walbaum) 1929-1969. Fish. Res. Bd. Canada Technical Report No. 176, 60 p.

12669. Hamilton, J. A. R., L. O. Rothfus, M. W. Erho, J. D. Remington. 1970. USE OF A HYDROELECTRIC RESERVOIR FOR THE REARING OF COHO SALMON (Oncorhynchus kisutch). State of Washington Dept. of Fisheries Research Bull. No. 9, 65 p.

Lake Merwin, a hydroelectric reservoir in the North Fork of the Lewis River in Washington, was examined to determine the feasibility of using a man-made lake for the rearing of coho salmon. Coho juveniles produced in Speelyai Hatchery were released into the lake in a series of tests. Tagging studies demonstrated that smolts migrated to, and congregated at, the outlet of the lake during the normal migration period. From 31% to 70% of the smolts were collected at the dam but the total catch each year represented only a small portion of the fish introduced initially into the lake. The major cause of low migration numbers was low survival. Coho grew to a large size in Lake Merwin during their first year. Zooplankton comprised the principal food of lake fish in contrast to insects for fish in Speelyai Creek. The chemical and thermal properties of the lake examined were suitable for rearing coho. Enclosure studies indicated that predation accounted for nearly half the mortality to coho in the lake. Squawfish and rainbow trout were the principal predators. Squawfish control measures resulted in no improvement in coho survival. Although precocious males comprised the bulk of marked coho returning from the ocean to Merwin Dam, the rate of return of smolts as 3_2 individuals was similar to those for Speelyai Creek and certain other coho races. It was concluded that certain conditions, principally predation, precluded the use of Lake Merwin as a rearing area for coho salmon. (Authors)

12670. Maxfield, Galen H., Robert H. Lander, and Charles D. Volz (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1970. LABORATORY TESTS OF AN ELECTRICAL BARRIER FOR CONTROLLING PREDATION BY NORTHERN SQUAWFISH. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Special Scientific Report - Fisheries No. 611, 8 p., illus.

Northern squawfish (Ptychocheilus oregonensis) prey extensively on the young of sport and commercial fishes. Of particular concern to us was their heavy predation during early spring and summer on salmon (Oncorhynchus spp.) that are released from upstream hatcheries on the Columbia River and must pass through squawfish-infested areas on their way to the sea. Control of these predators entailed finding a means of blocking their passage into the release areas of the hatchery-reared salmon without interfering with the outmigration. For this purpose, we explored in the laboratory the effectiveness of electrical fields previously found to direct the movements of salmon fingerlings. Electrical fields were produced by two rows of hollow aluminum electrodes suspended in the water across a laboratory tank. Exploratory tests were run to determine what combinations of electrode arrays, voltage gradients, and electrical conditions would give results warranting systematic testing. Ten fish were tested individually in each of these elimination tests. On the basis of test results, four electrode arrays, with capacitor discharge pulses at 8 pulses per second and a pulse duration equivalent to that of 40 millisecond "rectangular pulse," were tested at three voltage gradients. A staggered array of electrodes in which the electrodes were spaced at 61-cm. intervals in rows 200 cm. apart was most effective. At the voltage gradients of 0.75, 1.00, and 1.25 volts per centimeter, 85, 93, and 96 percent respectively, of the squawfish were blocked. (Authors)

12671. Vickers, K. U., and Violet Magill (Fish. Branch, Ministry of Agric., Northern Ireland). 1970. DOES REMOVAL OF TROUT IMPROVE SALMON PRODUCTION? Foyle Fish. Comm. Eighteenth Annual Report, 1968-1969, pp. 46-55.

For some years in the Foyle Area and elsewhere it has been the practice to remove trout, Salmo trutta (L), from salmonid nursery areas by electric fishing prior to the introduction of hatchery produced fry of salmon, Salmo salar L. The results of this preliminary investigation indicate that partial removal of trout does not benefit the juvenile salmon stock.

12672. Johnson, Howard E., and Charles Pecor (Fish. & Wildl. Dept., Michigan State Univ., East Lansing, Michigan). 1969. COHO SALMON MORTALITY AND DDT IN LAKE MICHIGAN. Thirty-fourth North American Wildlife and Natural Resources Conf. March 2, 3, 4, 5, 1969, Washington, D. C., pp. 159-166.

Preliminary investigations were initiated in 1967 to identify and quantify pesticide residues in coho salmon eggs in Lake Michigan and to determine their effects on the hatching fry. DDT concentrations in Lake Michigan coho salmon eggs were three to five times higher than in those from Lake Superior and approximately 60 times higher than in eggs from Oregon. A mortality syndrome, characterized by an abrupt appearance of symptoms during the last stage of yolk sac absorption, was observed in all groups from Lake Michigan. No evidence of the symptoms was observed in Lake Superior and Oregon groups. Higher residues in the eggs of Lake Michigan salmon were, in general, associated with higher mortalities of the fry. Significantly higher concentrations of DDT were found in affected fry than in non-affected fry from the same female. DDT concentrations in the last fractions of yolk present in the gut when symptoms first appeared were 6 to 12 times higher than in the body tissues. The absorption of relatively high concentrations of DDT from the gut is suggested as an explanation for the mortality of the coho salmon fry. (From authors summ.)

12673. Went, Arthur E. J. 1970. NOTES ON SALMON OF THE RIVER FOYLE (1969). Foyle Fish. Comm. Eighteenth Annual Report, 1968-1969, pp. 56-60.

There is confirmation for the second year running that a weight division of eight pounds is not satisfactory under present conditions to separate, for scientific purposes, grilse from salmon.

12674. Fribourgh, James H., Dale E. McClendon, and Bernard L. Soloff (Little Rock Univ., Little Rock, Arkansas). 1970. ULTRASTRUCTURE OF THE GOLDFISH, Carassius auratus (CYPRINIDAE), SPERMATOZOON. Copeia, No. 2, pp. 274-279.

The ultrastructure of the goldfish spermatozoon (Carassius auratus) is described. The entire spermatozoon is approximately 60μ in length and is comprised of a head, lobe and flagellum. The head is spherical and has a diameter of about 3.2μ. A lobe, containing 2-4 mitochondria, extends from the posterior region of the head. The lobe encircles the flagellum but it is separated from it. The flagellum consists of the typical 9 + 2 axoneme. In several sections through the tail, the two central fibers appear to be connected by a single strand. The nine outer fibers are composed of subfibers A and B. Arms, extending toward the next fiber, arise from subfiber A of each doublet. A faint and irregular pattern, suggestive of the radial lamellae described for sea urchin sperm tails, is noted.

12675. Lewis, William M., Jr. (Dept. of Zool., Univ. of North Carolina, Chapel Hill, North Carolina). 1970. MORPHOLOGICAL ADAPTATIONS OF CYPRINODONTOIDS FOR INHABITING OXYGEN DEFICIENT WATERS. Copeia, No. 2, pp. 319-326.

A previously unrecognized morphological adaptation of fishes to oxygen depletion is described. Natural oxygen depletion was simulated by use of sodium sulfite. It was demonstrated that some fishes are adapted to permit use of an oxygen rich layer of water at the atmosphere-water interface. Representative cyprinodontoids (Fundulus notatus, Gambusia affinis, and Poecilia reticulata) exhibited maximum adaptation and the greatest survival ability of the species tested. Notemigonus crysoleucas, Brachydanio rerio, Lepomis macrochirus, and L. cyanellus, representing other suborders, showed less adaptation to these conditions and correspondingly lower survival. Micropterus salmoides seemed unadapted for survival in oxygen depleted waters. Carassius auratus exhibited a physiological adaptation, but used the oxygen rich surface water as a supplement.

12676. Saunders, Lloyd H., and G. Power (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1970. POPULATION ECOLOGY OF THE BROOK TROUT, Salvelinus fontinalis, IN MATAMEK LAKE, QUEBEC. J. Fish. Res. Bd. Can., 27(3): 413-424.

Population estimates of an unexploited brook trout population at Matamek Lake, Quebec, indicated that more than 86% of the total population inhabited the tributaries of the lake during the summer of 1968. As opposed to the stream habitat, the combination stream-lake ecosystem moderated the mortality rates of the intermediate age-groups and allowed survival to higher ages in the population. Estimates of standing stock and production in the lake were 3.1 and 2.2 kg/ha respectively during 1968. The population was characterized by a slower growth rate, higher age at maturity, higher survival rate in the intermediate age groups, and longer life span when compared with an exploited population in Wisconsin. Increased numbers of trout in higher age-groups at Matamek Lake were attributed to high survival rates in the intermediate age-groups in the absence of exploitation. Low estimates of standing stock and production were attributed to environmental factors affecting growth. (Authors)

12677. Johnson, M. G., M. F. P. Michalski, and A. E. Christie (Ontario Water Resources Comm., Toronto, Ont., Canada). 1970. EFFECTS OF ACID MINE WASTES ON PHYTOPLANKTON COMMUNITIES OF TWO NORTHERN ONTARIO LAKES. J. Fish. Res. Bd. Can., 27(3): 425-444.

Differences in chemical composition in 1965-67 between two lakes contaminated by uranium-milling wastes and one unaffected lake were related directly to the nature of processes in uranium extraction and subsequent waste treatment. Low pH and high concentrations of SO_4^{-2}, NO_3^{-1}, and Ca^{+2} occurred in the contaminated lakes. Lower phytoplankton populations and lower indices of diversity were found in the contaminated lakes. Average primary productivities were approximately 70 and 30 mg C m^{-2} day^{-1} in the two contaminated lakes and 130 mg C m^{-2} day^{-1} in the unaffected lake. (From auth.)

12678. Houde, Edward D., and John L. Forney (Dept. of Conservation, Cornell Univ., Ithaca, New York). 1970. EFFECTS OF WATER CURRENTS ON DISTRIBUTION OF WALLEYE LARVAE IN ONEIDA LAKE, NEW YORK. J. Fish. Res. Bd. Can., 27(3): 445-456.

Distribution of walleye (Stizostedion vitreum vitreum) larvae in Oneida Lake was followed in 1960-67 from the time 200 million 1- to 3-day-old larvae were stocked until dispersal was complete 10-15 days later. The distribution of prolarvae indicated a high proportion of the population originated from stocking. Newly stocked larvae concentrated near bottom and were transported by bottom currents into the western third of the lake. Older larvae were most abundant near the surface after yolk absorption and they were transported east by surface currents generated by the predominantly westerly winds. Distribution of larvae 8-9 days after release in 1966 and 1967 was similar to the distribution predicted from water current and wind velocity data. Larvae were dispersed further east in 1967, when winds were strong, than in 1966, when wind velocity was low. (Authors)

12679. Fagerlund, U. H. M. (Fish. Res. Bd. Canada Vancouver Lab., Vancouver British Columbia, Canada). 1970. DETERMINING CORTISOL AND CORTISONE SIMULTANEOUSLY IN SALMONID PLASMA BY COMPETITIVE PROTEIN BINDING. J. Fish. Res. Bd. Can., 27(3): 596-601.

A method was developed for the simultaneous determination of nanogram quantities of cortisol and cortisone in 0.1-ml samples of salmonid plasma by competitive protein binding (CPB). The steroids were separated by thin-layer chromatography on silica gel and CPB analysis was performed with chicken serum in the presence of Florisil. (Auth.)

12680. Hara, Toshiaki, J., (Fish. Res. Bd. Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1970. AN ELECTROPHYSIOLOGICAL BASIS FOR OLFACTORY DISCRIMINATION IN HOMING SALMON: A REVIEW. J. Fish. Res. Bd. Can., 27(3): 565-586.

Past and current researches relating to olfactory acuity and discrimination in fishes, with special reference to homing salmon, are reviewed. (From auth.)

12681. Dodge, Douglas P., and Hugh R. MacCrimmon (Dept. of Zool., Univ. of Guelph, Guelph, Ont., Canada). 1970. VITAL STATISTICS OF A POPULATION OF GREAT LAKES RAINBOW TROUT (Salmo gairdneri) CHARACTERIZED BY AN EXTENDED SPAWNING SEASON. J. Fish. Res. Bd. Can., 27(3): 613-618.

Adult fish moved into Bothwell's Creek, Lake Huron, between October 29 and May 3. Run A (October 29-February 15) was composed of 640 fish, run B (February 16-May 3) of 610 fish. Run A spawned between December 29 and February 14 and left the river. Run B spawned between February 20 and April 30. Total lengths of males ranged from 31 to 80 cm, females from 21 to 90 cm. Fourteen categories of life history were identified within the population of which 99% had become smolts after 2 years of stream life. Fish of age 5 were dominant. Differences in age class structure and size of fish occurred between runs A and B. Sea lamprey scars were evident on 8.6% of fish, all over 46 cm in total length. (Authors)

12682. Lucas, Henry F., Jr., David N. Edgington and Peter J. Colby (Radiological Physics Div., Argonne National Lab., Argonne, Illinois). 1970. CONCENTRATIONS OF TRACE ELEMENTS IN GREAT LAKES FISHES. J. Fish. Res. Bd. Can., 27(4): 677-684.

The concentration of 15 trace elements was determined by activation analysis of samples of whole fish and fish livers from Lakes Michigan, Superior, and Erie. The average concentrations of 7 elements in 19 whole fish from 3 species were: uranium, 3 ppb; thorium, 6 ppb; cobalt, 28 ppb; cadmium, 94 ppb; arsenic, 16 ppb; chromium, 1 ppm; and copper, 1.3 ppm. The average concentrations of 8 elements in 40 liver samples from 10 species of fish were: uranium, $\sim$ 2 ppb; thorium, $\leq$ 2 ppb; cobalt, 40 ppb; copper, 9 ppm; zinc, 30 ppm; bromine, 0.4 ppm; arsenic, 30 ppb; and cadmium, 0.4 ppm. Other elements observed in most of the samples were: antimony, 5-100 ppb; gold, 2-5 ppb; lanthanum, 1-20 ppb; rhenium, 0.5-5 ppb; rubidium, 0.06-4 ppm; and selenium, 0.1-2 ppb. Trace element concentrations varied with species and lake. Uranium and thorium varied with species, but not for the same species from different lakes. The levels of copper, cobalt, zinc, and bromine varied little between species and lakes. The concentration of cadmium, arsenic, and chromium varied between species and with species between lakes. (Authors)

12683. McCleave, James D., and Ross M. Horrall (Dept. of Zool., Univ. of Maine, Orono, Maine). 1970. ULTRASONIC TRACKING OF HOMING CUTTHROAT TROUT (Salmo clarki) IN YELLOWSTONE LAKE. J. Fish. Res. Bd. Can., 27(4): 715-730.

Displacement of 42 mature cutthroat trout (Salmo clarki) from their spawning tributaries to the open water of Yellowstone Lake in the summers of 1966 and 1968 and following them ultrasonically up to 13.5 hr and 11.8 km indicated that those that homed used a compass mechanism rather than search or true navigation to find shore and then followed the shoreline to the home stream. Vision was unnecessary for homing. For many of the fish whose movements showed no consistent pattern, the transmitters failed prematurely. (From authors)

12684. Swingle, Wayne E., and H. S. Swingle. 1965. INSTRUCTIONS FOR POPULATION ANALYSIS PROGRAMS FOR IBM 1620 IN FORTAN/FORMAT (FORTAN I). Alabama Dept. of Conservation, Game and Fish Div., Fisheries Report No. 3, 25 p.

12685. Dowd, R. G., E. Bakken, and O. Nakken (Fish. Res. Bd. Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1970. A COMPARISON BETWEEN TWO SONIC MEASURING SYSTEMS FOR DEMERSAL FISH. J. Fish. Res. Bd. Can., 27(4): 737-742.

Two sonic methods for estimation of abundance of fish stocks, the echo integrator and the digital counter methods, were compared on single and schooling fish in the Lofoten area of Norway during March 1969. Good correlation was obtained between the two systems for both situations, but the slopes of the regressions of integrated values on the digital counter differed significantly between low and high density fish concentrations. This suggests that the two systems treated the echo information differently, but nevertheless maintained a linear relation between themselves over a wide range of counts. (Authors)

12686. MacCrimmon, Hugh R., T. Larry Marshall, and Barra L. Gots (Dept. of Zool., Univ. of Guelph, Guelph, Ont., Canada). 1970. WORLD DISTRIBUTION OF BROWN TROUT, Salmo trutta: FURTHER OBSERVATIONS. J. Fish. Res. Bd. Can., 27(4): 811-818.

This note supplements the original paper by MacCrimmon and Marshall (J. Fish. Res. Bd. Canada: 2527-2548, 1968) in presenting modified and more complete information on the native range, attempted introductions, and present world distribution of the brown trout. (Authors)

12687. Otto, Robert G., and John E. McInerney (Dept. of Biol., Univ. of Victoria, Victoria, Brit. Columbia, Canada). 1970. DEVELOPMENT OF SALINITY PREFERENCE IN PRE-SMOLT COHO SALMON, Oncorhynchus kisutch. J. Fish. Res. Bd. Can., 27(4): 793-800.

When tested in a horizontal salinity gradient, freshwater-adapted coho salmon exhibited a bimodal preference response throughout most of the pre-smolt period. Preference modes were located at fresh water and at a salinity intermediate between fresh and sea water. The concentration of the higher preferred salinity changed both with time and instantaneously with the dimensions of the test gradient. Fish tested in a gradient that originated at 4 °/oo exhibited a single preferred salinity at 7 °/oo in June, which increased gradually to 13 °/oo by February. The same fish tested in a gradient originating at fresh water showed a corresponding preference for an intermediate salinity in addition to their preference for fresh water. However, this second preferendum was at a somewhat lower salinity than that observed in tests in which fresh water was excluded from the gradient. With the approach of the smolt transformation, preference for fresh water was greatly reduced and the response distribution became unimodal. At no time during the period prior to the smolt transformation did the preferred salinity exceed 14 °/oo. (Authors)

12688. Purvis, Harold A. (Bur. of Comm. Fish., Biol. Sta., Marquette, Michigan). 1970. GROWTH, AGE AT METAMORPHOSIS, AND SEX RATIO OF NORTHERN BROOK LAMPREY IN A TRIBUTARY OF SOUTHERN LAKE SUPERIOR. Copeia, No. 2, pp. 326-332.

Growth was studied of five year classes of the northern brook lamprey, Ichthyomyzon fossor, collected from the Sturgeon River during intervals between treatment of the stream with a lampricide. Growth varied considerably among year classes. Larvae of the 1963 year class were slightly longer at age II and 30% longer at age III than the III-group lampreys of the 1963 year class. About 6% of 558 III-group lampreys of the 1963 year class had metamorphosed by 17 August 1966. Although the sex ratio of larvae was about 1:1, 97% of the metamorphosed lampreys were males. The distribution of pigmentation on the caudal fin and upper lip in ammocoetes less than 40 mm long permitted accurate and rapid separation of northern brook lampreys from the sea lamprey, Petromyzon marinus. (Auth.)

12689. Stoklosowa, Stanislawa (Dept. of Animal Physiol., Jagiellonian Univ., Cracow, Poland). 1970. FURTHER OBSERVATIONS ON THE SEXUAL DIMORPHISM IN THE SKIN OF Salmo trutta trutta IN RELATION TO SEXUAL MATURITY. Copeia, No. 2, pp. 332-339.

A study of skin structure of juvenile sea trout, Salmo trutta trutta, from the Reda River, northern Poland, and from artificial ponds, where they bred, reveals differences between males and females. There are some differences in skin structure of specimens which had spawned and adult sea-ascending males and females. Obvious differences are evident between adult males and females of Lake Wdzydze trout, Salmo trutta trutta morpha lacustris. Comparing the state of gonad development, differences between "summer" and "autumn" migratory trout populations are shown histologically. (Auth.)

12690. Warner, Kendall (Maine Dept. of Inland Fisheries and Game, Bangor, Maine). 1970. AGE AND GROWTH OF BROOK TROUT, Salvelinus fontinalis, IN SOME NORTHERN MAINE STREAMS. Copeia, No. 2, pp. 358-360.

Growth data were collected for 1049 brook trout Salvelinus fontinalis, during surveys of 38 streams in northern Aroostook Co., Me., from 1959 through 1962. In most streams age I trout averaged 104-140 mm (4.1 - 5.5 inches) (weighted mean 116.8 mm, 4.6 inches) in July. Mean total lengths of age II trout ranged from 141-190 mm (5.6 - 7.5 inches), with a weighted mean of 154.9 (6.1 inches). Age III trout were scarce; their mean lengths ranged from 155-241 mm (6.1 - 9.5 inches; weighted mean 198.1 mm, 7.8 inches). Mean annual increment from age I to age III was less than 51 mm (2 inches). Brook trout in the Maine streams studied generally had a short life span, a slow growth rate, and a high mortality rate. Most of the trout in these streams apparently die of natural causes before reaching the minimum legal length limit of 6 inches. -- Robert M. Howland

12691. Olla, Bori L., Harvey M. Katz, and Anne L. Studholme (U. S. Bur. of Sport Fisheries and Wildlife, Sandy Hook Mar. Lab., Highlands, New Jersey). 1970. PREY CAPTURE AND FEEDING MOTIVATION IN THE BLUEFISH, Pomatomus saltatrix. Copeia, No. 2, pp. 360-362.

Bluefish, Pomatomus saltatrix (Linnaeus), marine pelagic predators, held under controlled laboratory conditions were observed for their feeding behavior in response to living prey. Responses of the fish were classified as follows: 1) Initial perception: When prey hit the surface, the bluefish school broke up and swimming speed increased from 40-60 cm/sec to 80-100 cm/sec. 2) Visual fixation: Eyes of individual fixed forward on prey. 3) Pursuit: Chased prey at as much as 800-1000 cm/sec. 4) Capture and ingestion: Within 15-25 cm of prey, bluefish lowered its mandible, arched its head, and extended its opercles. Upon ingestion it turned 90-180° right or left from attack direction. 5) Feeding intention and searching movements: Bluefish returned to site of previous capture; if no prey was found they swam downward and randomly in search. 6) Satiation: With satiation, swimming speed decreased 20-30% below pre-feeding speed; they swam in a tighter school in the lower quarter of the tank. -- Robert M. Howland.

12692. Sanders, Bob G. (Dept. of Zool., The Univ. of Texas, Austin, Texas). 1970. HEMOGLOBIN STUDIES IN THREE SPECIES AND A HYBRID TROUT (SALMONIDAE). Copeia, No. 2, pp. 367-370.

Hemoglobins obtained from rainbow-, brown-, and brook trout, and tiger trout (brown trout ♀ x brook trout ♂) were examined for electrophoretic, solubility and crystalline properties. The solubility curve and crystalline formation of the rainbow trout HbCO revealed patterns different from brown, brook, and tiger (hybrid) trout HbCO. Electrophoretic, solubility, and crystalline differences were not found in brown and brook trout. Therefore, the tiger trout hybrid hemoglobin resembled brown and brook trout parents. Should hemoglobin similarities be used as a criteria for phylogenetic relationships, such studies would suggest that brook and brown trout are more closely related than rainbow and brook trout. -- Robert M. Howland

12693. Christie, W. J. (Ontario Dept. of Lands and Forests, Glenora Fisheries Sta., Picton, Ont., Canada). 1970. INTRODUCTION OF THE CHERRY SALMON Oncorhynchus masou IN ALGONQUIN PARK, ONTARIO. Copeia, No. 2, pp. 378-379.

In July 1966, 5500 cherry salmon (250/lb.) were released in Westward Lake. The first recapture attempt, in 1967, yielded a 16.3 cm cherry salmon; the second, in 1968, — 3 maturing females, 35.1, 33.3 and 34.0 cm in length. Between October 12 and 18, twelve sexually mature specimens were gillnetted; average length was 37.8 cm. There were six of each sex. Spawning occurred in the lake. Further stockings are being made in this lake to study food habits, distribution, and other aspects of their life history. This work is part of a broad search for exotic species with potential to restore the depreciated fisheries of the Great Lakes. -- Robert M. Howland

12694. MacCrimmon, H. R., and J. R. M. Kelso (Dept. of Zool., Univ. of Guelph, Guelph, Ont., Canada). 1970. SEASONAL VARIATION IN SELECTED NUTRIENTS OF A RIVER SYSTEM. J. Fish. Res. Bd. Can., 27(5): 837-846.

Water samples were collected biweekly from five locations on the Grand River, Ont., from August 16, 1967 to September 1, 1968. Headwater nutrient levels and associated water chemistry were radically altered by the influence of a small city. Processes of recovery occurred downriver in a primarily agricultural watershed. Levels of dissolved oxygen, carbon dioxide, pH, alkalinity, hardness, ammonia, nitrate, and silica followed similar seasonal patterns at all locations. High and widely fluctuating levels of chloride, ammonia, nitrate-N, nitrite, and orthophosphate were evidence of gross enrichment. Nitrate-N, orthophosphate, iron, and sulfate levels varied irregularly during the 13-month period. (Authors)

12695. Duthie, Hamish C., and John C. H. Carter (Dept. of Biol., Univ. of Waterloo, Waterloo, Ont., Canada). 1970. THE MEROMIXIS OF SUNFISH LAKE, SOUTHERN ONTARIO. J. Fish. Res. Bd. Can., 27(5): 847-856.

In the meromictic Sunfish Lake the large populations of phytoplankton that are observed periodically were associated with circulation of the mixolimnion. Perhaps some organic dissimilation took place in the lower mixolimnion, recycling nutrients during spring and fall circulation. Phytoplankton was practically absent from the epilimnion during the summer but a population of Oscillatoria agardhii remained in the metalimnion, where it was responsible for a pronounced and persistent metalimnetic oxygen maximum. The monimolimnion contained about 5100 mg/liter of dissolved solids and the upper mixolimnion about 2200 mg/liter. Ventilation of the monimolimnion did not always coincide with circulation and subsurface springs may have been responsible. Circulation to the lake bottom was observed only once in 18 months. (Authors)

12696. Bilinski, E., and R. E. E. Jonas (Fish. Res. Bd. of Can., Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1970. EFFECTS OF COENZYME A AND CARNITINE ON FATTY ACID OXIDATION BY RAINBOW TROUT MITOCHONDRIA. J. Fish. Res. Bd. Can., 27(5): 857-864.

The effects of coenzyme A (CoA) and carnitine on the oxidation of 0.1 mM K-palmitate-1-^{14}C and K-oleate-1-^{14}C by mitochondrial fractions from lateral line muscle, white muscle, heart, liver, and kidney was studied in rainbow trout (Salmo gairdneri). CoA (0.01-0.10 mM) stimulated the oxidation of fatty acids by mitochondria from lateral line muscle and heart. With all the preparations of mitochondria, fatty acid oxidation was increased by addition of carnitine (1.0 mM) and in the presence of carnitine (1.0 mM), CoA (0.1-1.0 mM) gave a further increase in oxidative activity. Mitochondria from lateral line muscle and heart showed the same range of maximal activity (oxidized substrate at 15C = 180-200 nmoles/mg N per hr), which was considerably above that found with mitochondria from other tissues. The results suggest similarities in the energy-supplying metabolism in lateral line muscle and heart of trout with respect to the utilization of fatty acids. (Authors)

12697. Platt, Trevor, and D. V. Subba Rao (Fish. Res. Bd. Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1970. PRIMARY PRODUCTION MEASUREMENTS ON A NATURAL PLANKTON BLOOM. J. Fish. Res. Bd. Can., 27(5): 887-899.

A comprehensive series of observations made throughout a natural phytoplankton bloom suggested that culture experiments are satisfactory analogues of natural plankton systems, at least under bloom conditions. Calorific values suggested that there was no tendency for the phytoplankton to store fat in the senescent phase of the bloom. No single quantity was found to be a suitable indicator of the physiological vigour of the population. (Authors)

12698. Wedemeyer, Gary (Bur. of Sport Fish. and Wildl., Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Washington). 1970. STRESS OF ANESTHESIA WITH M. S. 222 AND BENZOCAINE IN RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Can., 27(5): 909-914.

Rainbow trout (Salmo gairdneri) anesthetized with M. S. 222 for periods up to 12 min experience interrenal ascorbate depletion, uremia, and moderate hypercholesterolemia. Anesthesia with neutralized M. S. 222 (pH 7) or benzocaine prevented these changes and significantly reduced the variability in plasma glucose, cholesterol, and cortisol, indicating that the stress of anesthesia with M. S. 222 is due to the low pK of the sulfonic acid moiety. (Auth.)

12699. Uthe, J. F., and R. A. Ryder (Fish. Res. Bd. Can., Freshwater Inst., Winnipeg, Manitoba, Canada). 1970. REGIONAL VARIATION IN MUSCLE MYOGEN POLYMORPHISM IN WALLEYE (Stizostedion vitreum vitreum) AS RELATED TO MORPHOLOGY. J. Fish. Res. Bd. Can., 27(5): 923-927.

In a survey of walleye (Stizostedion vitreum vitreum) from several lakes in central Canada, starch-gel electrophoresis of muscle myogens showed only the three phenotypes previously reported from Lake St. Clair. Measurements of body ratios and counts of interneural and interhaemal spines and of vertebrae gave no morphological basis for distinguishing between the three protein phenotypes. Although phenotype frequencies varied from lake to lake, within lakes the observed frequencies appeared to agree well with those calculated according to the Hardy-Weinberg rule assuming control by two nondominant alleles. The geographical variation was also consistent with the idea of reinvasion of the sample area from two separate refugia. (Authors)

12700. Groves, T. D. D. (Dept. of Bacteriol. and Biochem., Univ. of Victoria, Victoria, Brit. Columbia, Canada). 1970. BODY COMPOSITION CHANGES DURING GROWTH IN YOUNG SOCKEYE (Oncorhychus nerka) IN FRESH WATER. J. Fish. Res. Bd. Can., 27(5): 929-942.

The body composition of young sockeye (Oncorhynchus nerka) in the weight range of 0.5 - 300 g was investigated to further document changes in body composition with growth, and to develop equations that would allow the estimation of total body composition in this species, either in vitro or in vivo, based on easily measured parameters such as fork length, live weight, and total body water. The major components of the fat-free mass (protein, water, and ash) in nonstarving fish were closely related to each other and to fork length. Body fat tended to increase with size, but was not closely related to the other components of body composition. The following equations were derived, allowing the accurate estimation of total water (W), protein (P), and fat-free dry material (FFDM, consisting of protein and ash) in grams, based on the measurement of either water or fork length (L) in centimeters: $W = 0.00571\ L^{3.118}$, $P = 0.204\ W^{1.038}$, and $FFDM = 1.113\ P$. Body fat (F) may be estimated as the difference between wet body weight (M) and the lean mass: $F = M-(W + FFDM)$. (From auth.)

12701. Rogers, Wilmer A., and Mac V. Rawson (Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. TWO NEW SPECIES OF Cleidodiscus (MONOGENEA) FROM THE SOUTHEASTERN U. S. Reprint from Proc. of the Helminthological Soc. of Washington, 36(2): 248-249.

12702. Johnson, A. G., F. M. Utter, and H. O. Hodgins (Bur. of Comm. Fish., Biol. Lab., Seattle, Washington). 1970. ELECTROPHORETIC VARIANTS OF L-ALPHA-GLYCEROPHOSPHATE DEHYDROGENASE IN PACIFIC OCEAN PERCH (Sebastodes alutus). J. Fish. Res. Bd. Can., 27(5): 943-945.

Three phenotypes of L-alpha-glycerophosphate dehydrogenase (α - GPDH) were found in muscle extracts of Pacific Ocean perch by starch-gel electrophoresis. No association was obvious between alpha-glycerophosphate phenotype and sex or stage of maturity. The observed phenotypes were presumed to be under the control of two allelic genes, F and S. This assumption was supported by the distribution of phenotypes of fish collected off the coasts of Washington and Oregon. This report is the first on genetic variants of an enzyme in Pacific Ocean perch and suggests that isoenzymes of α- GPDH may be useful in population studies of this species. (Authors)

12703. Hunter, Charles J., and Winston E. Farr (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1970. LARGE FLOATING STRUCTURE FOR HOLDING ADULT PACIFIC SALMON (Oncorhynchus spp.). J. Fish. Res. Bd. Can., 27(5): 947-950.

A large floating enclosure was used in a behavioral study to hold adult Pacific salmon in open sea water. The space enclosed approached the conditions of the natural environment and provided an excellent study area, almost completely free from the injuries and disease associated with the high water temperatures and abrasions caused by confinement of adult salmon in concrete ponds. (Authors)

12704. Pesch, Gerald (Grad. School of Oceanography, Univ. of Rhode Island, Kingston, Rhode Island). 1970. PLASMA PROTEIN VARIATION IN A WINTER FLOUNDER (Pseudopleuronectes americanus) POPULATION. J. Fish. Res. Bd. Can., 27(5): 951-954.

The plasma protein variations of winter flounder (Pseudopleuronectes americanus) were studied by cellulose acetate electrophoresis. Eighty-eight fish caught in a single haul showed pattern differences associated with gonad maturation, sex, disease, and age. The groups of slow and medium mobility were prominent. A fast fraction with greater mobility than human albumin was present. Total concentrations increased with gonad maturation; in males the fast fraction was responsible, in females the slow fraction. Disease caused a drop in concentration for all fractions. Aging had associated concentration increases in the slow and medium fractions with no increase in the fast fraction. (Auth.)

12705. Yasutake, W. T., and Harold Wolf (Bur. of Sport Fish. and Wildl., Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Washington). 1970. OCCURRENCE OF WHIRLING DISEASE OF TROUT IN WESTERN UNITED STATES. J. Fish. Res. Bd. Can., 27(5): 955-956.

Whirling disease of trout, caused by Myxosoma cerebralis, was diagnosed in 1966 for the first time in rainbow trout (Salmo gairdneri) from California and Nevada hatcheries. In 1969 the first incidence of this disease in cutthroat trout (S. clarki) was reported in Nevada. To date these have been the only confirmed cases of whirling disease in western United States. (Authors)

12706. Dunn, R. S. (Fish. Res. Bd. Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1970. FURTHER EVIDENCE FOR A THREE-YEAR OOCYTE MATURATION TIME IN THE WINTER FLOUNDER (Pseudopleuronectes americanus). J. Fish. Res. Bd. Can., 27(5): 957-960.

Evidence is presented for autumn growth of yolkless oocytes, which would tend to split the oocytes into two size groups. (Auth.)

12707. Rogers, Wilmer A. (Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1968. Pseudacolpenteron pavlovskyi Bychowsky and Gussev, 1955 (MONOGENEA), FROM NORTH AMERICA, WITH NOTES ON ITS TAXONOMIC STATUS. Reprint from J. Parasit., 54(2): p. 339.

12708. Knight, William (Dept. of Math., University of New Brunswick, Fredericton, New Brunswick, Canada). 1970. A POSSIBLE OPTIMIZATION EXPERIMENT IN FISHERY MANAGEMENT. J. Fish. Res. Bd. Can., 27(5): 961-963.

A tag-recapture method for deciding whether a change in effort governing regulations will improve a fishery or the opposite is proposed. When the criterion is weight of catch, this reduces to seeing whether the total weight of fish recaptured in a certain tag-recapture experiment exceeds the total weight of fish released. Most of the many practical objections besetting this experiment are common to any method depending on tag-recapture methods to estimate rate of exploitation. (Auth.)

12709. Pippy, John H. C. (Fish. Res. Bd. Canada, Biol. Sta., St. John's, Newfoundland, Canada). 1970. USE OF ULTRAVIOLET LIGHT TO FIND PARASITIC NEMATODES IN SITU. J. Fish. Res. Bd. Can., 27(5): 963-965.

The parasitic nematodes Anisakis sp., Contracaecum aduncum, and Phocanema decipiens fluoresce when irradiated by ultraviolet light (360 mμ). Fluorescence greatly simplifies searching for the nematodes in situ when they are not deeply embedded in host tissues. Also, differences in fluorescence quality enable immediate preliminary identification of specimens. The method is particularly well suited for long-term investigations or when accurate counts are necessary. (Auth.)

12710. Krantz, George E., and Carroll E. Heist (Bur. of Comm. Fish. Biol. Lab., Oxford, Maryland). 1970. PREVALENCE OF NATURALLY ACQUIRED AGGLUTINATING ANTIBODIES AGAINST Aeromonas salmonicida IN HATCHERY TROUT IN CENTRAL PENNSYLVANIA. J. Fish. Res. Bd. Can., 27(5): 696-973.

A survey for naturally acquired antibodies against Aeromonas salmonicida in brook and brown trout in central Pennsylvania hatcheries showed great variation in the percentage of reactive individuals (0.8 - 87%) within 24 populations. Antibodies were not detected in fish less than 12 months old, and the percentage of serologically reactive individuals increased with the age of the population. Prevalence of antibodies in yearling trout populations in which furunculosis was epizootic was about twice as great as in fish experiencing enzootic furunculosis. (Authors)

12711. Crozier, George F. (Mar. Sci. Inst., Univ. of Alabama, Bayou LaBatre, Alabama). 1970. TISSUE CAROTENOIDS IN PRESPAWNING AND SPAWNING SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Can., 27(5): 973-975.

Spawning sockeye salmon from the Wauk Wash River, B. C., contained 65% less carotenoid than prespawning fish taken at sea near Juneau, Alaska. Free astaxanthin in the muscle of spawning fish was only 1% of the amount noted for prespawning fish. Ninety-five percent of the pigment retained by the spawning males was located in the skin as esters and 85% of the pigment of spawning females was deposited in the eggs as free astaxanthin. (Auth.)

12712. Fry, F. E. J., and E. T. Cox (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1970. A RELATION OF SIZE TO SWIMMING SPEED IN RAINBOW TROUT. J. Fish. Res. Bd. Can., 27(5): 976-978.

Cruising speed at 10C of rainbow trout 4-100 g was measured in a rotating chamber and found to vary as weight $^{0.13}$. Weight varied as length $^{2.91}$, so that swimming speed was dependent on length $^{0.4}$, close to the relation found for other salmonids by other authors. A 10-g fish could swim at approximately 9 body lengths (L) sec^{-1} whereas at 100 g the cruising speed was 5.5 L sec^{-1}. By extrapolation the rate at 1000 g was 3L sec^{-1}. (Authors)

12713. Swingle, Wayne E. (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1964. INSTRUCTIONS FOR LENGTH-WEIGHT PROGRAMS FOR IBM 1620 IN FORTRAN-FORMAT (FORTRAN I). Auburn Univ. Zoology-Entomology Dept. Series - Fisheries No. 1, 19 p.

12714. Kennedy, W. A. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, B. C., Canada). 1970. MORTALITY OF DART-TAGGED CAPTIVE SABLEFISH (Anoplopoma fimbria). J. Fish. Res. Bd. Can., 27(5): 979-981.

Infection from dart tags killed sablefish (Anoplopoma fimbria) in a tank and in a net. Mortality began 3 months after tagging and reached a high level after 8 months that persisted for more than a year. At the observed mortality rate virtually all would die within a year. (Auth.)

12715. Johnston, C. E., and J. G. Eales (Dept. of Biol., Univ. of New Brunswick, Fredericton, N. B., Canada). 1970. INFLUENCE OF BODY SIZE ON SILVERING OF ATLANTIC SALMON (Salmo salar) AT PARR-SMOLT TRANSFORMATION. J. Fish. Res. Bd. Can., 27(5): 983-987.

Large yearling Atlantic salmon parr turn silvery more quickly than small parr when held under a series of controlled temperature and photoperiod regimes. Photoperiod appeared to exert a negligible influence on silvering, and water temperature was the main controlling variable. (Authors)

12716. Armstrong, Robert H. (Alaska Dept. of Fish and Game, Sport Fish Div., Subport Building, Juneau, Alaska). 1970. AGE, FOOD, AND MIGRATION OF DOLLY VARDEN SMOLTS IN SOUTHEASTERN ALASKA. J. Fish. Res. Bd. Can., 27(6): 991-1004.

Dolly Varden (Salvelinus malma) smolts were enumerated and sampled in 1967, 1968, and 1969 at Hood Bay Creek, a nonlake system on Admiralty Island, and in 1962, 1963, and 1964 at Eva Lake, on Baranof Island. Dolly Varden smolts left Hood Bay Creek from early May to late June and from early September to mid-November. At Eva Lake, a smolt migration occurred in May and June but not during the fall. Most of the smolts at Hood Bay Creek belonged to age-groups II, III, and IV and at Eva Lake to age-groups III and IV. Smolts from the two systems were similar in size, varying from 100 to 180 mm in fork length, with annual mean lengths ranging from 134 to 136 mm. Insects and fry of chum (Oncorhynchus keta) and pink salmon (O. gorbuscha) were the principal food items of Dolly Varden and coho salmon (O. kisutch) smolts sampled at the Hood Bay Creek weir in May and June. Dolly Varden smolts leaving Hood Bay Creek in the fall fed primarily on salmon eggs, whereas insects were the principal food items of smolts sampled at the Eva Lake weir. (From auth.)

12717. Brown, Joseph H., U. Theodore Hammer, and Gordon D. Koshinsky (Dept. of Biol., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada). 1970. BREEDING BIOLOGY OF THE LAKE CHUB, Couesius plumbeus, AT LAC LA RONGE, SASKATCHEWAN. J. Fish. Res. Bd. Can., 27(6): 1005-1015.

Spawning of the lake chub, Couesius plumbeus (Agassiz), was investigated at Lac la Ronge from 1966 to 1968. Nonadhesive eggs were freely dispersed in rocky shallows in the tributary Montreal River during May and along rocky shores of the lake in late June. Temperature played a regulating role and most breeding activity occurred after the water reached 10C. Some 4000 individuals were marked by finclipping and subsequent recaptures revealed that chubs migrated as much as 3 km in order to spawn in the river. Early arrivals in the river were cryptic. Males were somewhat aggressive during spawning but no territoriality was observed in the field. No nests were built and there was no parental guarding. Males outnumbered females on the spawning grounds and spawning activity was polyandrous. Males courted females by a combination of persistent pursuit and specially directed nudging. Sexual dimorphism was apparent in the larger pectoral fins, the more distinct dark lateral stripe, and the greater development of nuptial tubercles and orange breeding marks on males. (Authors)

12718. Swingle, Hugh A. (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1965. GROWTH RATES OF PADDLEFISH RECEIVING SUPPLEMENTAL FEEDING IN FERTILIZED PONDS. Reprint from U. S. Fish & Wildl. Serv., The Progressive Fish-Culturist, 27(4): p. 220.

12719. Berst, A. H., and G. R. Spangler (Ontario Dept. of Lands and Forests, Research Branch, Maple, Ontario, Canada). 1970. POPULATION DYNAMICS OF F_1 SPLAKE (Salvelinus fontinalis X S. namaycush) IN LAKE HURON. J. Fish. Res. Bd. Can., 27(6): 1017-1032.

Ninety-eight percent of 5391 F_1 splake recovered from a 1966 planting of 49,000 yearlings in Burnt Island Bay on the south shore of Manitoulin Island were taken within 32 km of the planting site. Remaining recaptures were made at distances up to 322 km. Growth rates of the hybrids in Lake Huron exceeded those reported for native and planted lake trout. A commercial size of 0.9 kg (2 lb) round weight was attained by the fall of their 2nd year in the lake. The splake grew rapidly through winter. Yearlings fed mainly on invertebrates and 2- to 4-year-olds fed almost entirely on fish. Eight percent of 3,054 hybrids examined had one or more lamprey marks. Fish less than 30 cm bore no evidence of lamprey attack. The onset of sexual maturity in both sexes occurred at age II. Fecundity of 3-year-old females averaged 2,512 eggs. (From authors)

12720. Noble, Richard L. (Dept. of Conserv., Cornell Univ., Ithaca, New York). 1970. EVALUATION OF THE MILLER HIGH-SPEED SAMPLER FOR SAMPLING YELLOW PERCH AND WALLEYE FRY. J. Fish. Res. Bd. Can., 27(6): 1033-1044.

Evaluation of avoidance of Miller samplers towed at 8 mph indicated that avoidance began when yellow perch fry were less than 8 mm long and increased as fry grew larger. Catches were increased by increasing towing speed to 11 mph, by using an electric shocking grid in front of the sampler, by using clear and translucent rather than dark opaque samplers, and by night sampling. A sampler with an aperture 1.5 times as large as the conventional Miller sampler was not more effective. Avoidance by walleye fry occurred, but was less well defined. Application of the results to the development of sampling techniques is discussed. (Auth.)

12721. Tedla, Shibru, and C. H. Fernando (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1970. SOME ASPECTS OF THE ECOLOGY OF THE PARASITE FAUNA OF THE GILLS OF YELLOW PERCH, Perca flavescens. J. Fish. Res. Bd. Can., 27(6): 1045-1050.

Three parasites, the monogenean Urocleidius adspectus, the copepod Ergasilus confusus, and the glochidia of Lampsilis radiata, were common on the gills of the yellow perch collected from the Bay of Quinte, Lake Ontario, from May 1967 to April 1968. No correlation was found between the incidences of infestation of these three parasites. Except for the glochidia, more parasites were found on the second and third gill arches than on the first and fourth. Other records from the gills were the glochidia of Elliptio complanatus, the myxosporidian Henneguya sp., and nonparasitic mites belonging to Hydrozetes sp. (Authors)

12722. Magnuson, John J., and Duane J. Karlen (Lab. of Limnol., Dept. of Zool., Univ. of Wisconsin, Madison, Wisconsin). 1970. VISUAL OBSERVATION OF FISH BENEATH THE ICE IN A WINTERKILL LAKE. J. Fish. Res. Bd. Can., 27(6): 1059-1068.

A device is described to directly observe fish behavior beneath the ice of a shallow lake. The viewing device, a 1.9-m tall plexiglass tube (14.0 cm inside diameter) sealed at the bottom, worked on the principle of a periscope. It was frozen into place in the center of a net enclosure. A man in a darkened hut lowered a mirror into the tube to observe the fish in the enclosure. Vertical distributions and behavior of 5 adult northern pike, 6 yellow perch, and 13 bluegills were compared with the levels of dissolved oxygen, free carbon dioxide, hydrogen sulfide, and water temperature. Observations in Mystery Lake, Wis., were made from Dec. 29, 1968 through Jan. 30, 1969, during a winterkill period. Yellow perch were the most active; northern pike the least. Bluegills remained farther beneath the ice than did the other two species. Northern pike stayed in domes formed under the ice. Northern pike and yellow perch frequently sounded into the anoxic layers. A combination of little locomotor activity and a position immediately beneath the ice apparently favored the longer survival of northern pike over bluegills and yellow perch. (From authors)

12723. Cameron, James N., and John C. Davis (Dept. of Zool., Univ. of British Columbia, Vancouver, B. C., Canada). 1970. GAS EXCHANGE IN RAINBOW TROUT (Salmo gairdneri) WITH VARYING BLOOD OXYGEN CAPACITY. J. Fish. Res. Bd. Can., 27(6): 1069-1085.

The effects of large changes in hemoglobin concentration were studied in rainbow trout in fresh water between 8 and 14 C. Anemia was produced by injecting phenylhydrazine hydrochloride or by replacing blood with either saline or plasma. The primary compensatory mechanism invoked was an increase in the cardiac output, which was accomplished almost entirely by increases in stroke volume. Although the viscosity of the blood was reduced, there must also be large changes in the peripheral resistance to blood flow, since greatly increased cardiac output was achieved without significant increase in blood pressure. The change in blood oxygen capacity and increase in cardiac output caused significant lowering of the ventilation-perfusion ratio, but the capacity rate ratio of water to blood varied only a little. The experiments illustrate what happens when blood oxygen capacity is reduced, and indicate that a species' hemoglobin level is maintained at a level that allows cardiac output to vary over an optimal range of its efficiency curve. (From authors)

12724. Marshall, T. Lawrence, and Hugh R. MacCrimmon (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1970. EXPLOITATION OF SELF-SUSTAINING ONTARIO STREAM POPULATIONS OF BROWN TROUT (Salmo trutta) AND BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Bd. Can., 27(6): 1087-1102.

The August standing crop of harvestable brown trout (Salmo trutta, 90%), and brook trout (Salvelinus fontinalis, 9%) in the upper Sydenham River, Ontario, was estimated at 499 trout/ha (63.2 kg/ha) during 1966 and 1967. Brown trout were of age I (68%), age II (23%), and the remainder of ages III, IV, V, and XIII. Brook trout were ages I (95%) and II only. The average annual harvest by 1501 anglers was 1135 fish (64% brown, 35% brook trout) at a rate of 0.34 fish/hr. Exploitation of the preseason standing populations of brown and brook trout was 23 and 59%, respectively. Catch per unit effort from the downriver section (all brown trout of ages II - IV and mean length of 34.0 cm) averaged 0.10 at an angling pressure of 264 hr/ha. An upriver section occupied predominantly (90%) by brown trout of age I - III and mean length of 26.8 cm yielded 0.67 trout/hr at an angling pressure of 251 hr/ha. (From authors)

12725. Timms, A. M., and H. Kleerekoper (Inst. of Life Sci., Texas A&M Univ., College Station, Texas). 1970. LOCOMOTOR RESPONSES OF BLINDED GOLDFISH (Carassius auratus) TO REMOTE PERCEPTION OF BARRIERS. J. Fish. Res. Bd. Can., 27(6): 1103-1107.

Comparison of locomotor responses of blinded goldfish with those reported for normal animals on approaching the walls of an experimental tank demonstrated that although visual perception of the walls played no role in the modification of frequency distribution of size of angles of turns, it was necessary for the observed change in velocity of locomotion. Observations on fish blinded in only one eye suggested that perspective vision was required for the control of turning frequency. (Authors)

12726. Clayton, J. W., and W. G. Franzin (Fish Res. Bd. of Can., Freshwater Inst., Winnipeg, Manitoba, Canada). 1970. GENETICS OF MULTIPLE LACTATE DEHYDROGENASE ISOENZYMES IN MUSCLE TISSUE OF LAKE WHITEFISH (Coregonus clupeaformis). J. Fish. Res. Bd. Can., 27(6): 1115-1121.

Electrophoresis of extracts of red lateral line muscle from lake whitefish (Coregonus clupeaformis) revealed two groups of lactate dehydrogenase (LDH) isozymes. In heart tissue extracts the faster moving set of isoenzymes predominated whereas most of the LDH in white muscle consisted of the slower set of electrophoretic isozymes. Three phenotypes of heart-type LDH isozymes were found in wild fish. Breeding experiments showed that there were two nondominant alleles at the locus coding the most anodal of the heart-type LDH subunits. The frequencies of these alleles were different in fish from two lakes. Our observations regarding the presence of discrete sets of multiple LDH isozymes in lake

whitefish and the independent genetic control of isozymes within each set provide additional evidence for the probable tetraploid nature of salmonids. (Authors)

12727. Dyer, W. J., D. F. Hiltz, R. G. Ackman, J. Gingley, and G. L. Fletcher (Fish.Res. Bd. Can., Halifax Lab., Halifax, Nova Scotia, Canada). 1970. IN VIVO ASSIMILATION BY COD MUSCLE AND LIVER TISSUE OF ELEMENTAL PHOSPHORUS FROM POLLUTED SEA WATER. J. Fish. Res. Bd. Can., 27(6): 1131-1139.

Cod rapidly assimilated elemental phosphorus from a seawater environment into their tissues. In a 16-hr exposure to a concentration of 20-80 ppb, phosphorus was concentrated a thousandfold in the liver (even more at lower exposure levels), from 10 to 25 times in white muscle, and about 50-100 times in red muscle. This distribution is roughly in proportion to lipid content. Distribution of the absorbed phosphorus is uniform throughout the white muscle of the fillet, thus facilitating sampling. (Authors)

12728. McCart, P., and Nevin Aspinwall (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1970. SPAWNING HABITS OF THE LARGESCALE SUCKER, Catostomus macrocheilus, AT STAVE LAKE, BRITISH COLUMBIA. J. Fish. Res. Bd. Can., 27(6): 1154-1158.

The spawning habits of the largescale sucker, Catostomus macrocheilus, were studied in the watershed of Stave Lake, British Columbia, during the spring of 1967. Spawning occurs in a variety of physical situations, in the inlet and outlet streams of lakes and on the gravelled lakeshores themselves. Spawning acts were observed during the day in some streams and at night in others. The largescale sucker is a mass spawner, with several males attending a single female. The eggs are deposited on, and beneath, the gravel surface. The spawning act is also described. (Authors)

12729. Wedemeyer, Gary, and K. Chatterton (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Washington). 1970. SOME BLOOD CHEMISTRY VALUES FOR THE RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Can., 27(6): 1162-1164.

Normal distribution curves were graphically fitted to approximately 1,400 clinical test values obtained from the plasma or kidney tissue of more than 200 yearling rainbow trout (Salmo gairdneri). Estimated normal ranges were ascorbate, 102-214 µg/g; blood urea nitrogen (BUN), 0.9-4.5 mg/100 ml; chloride, 84-132 m Eq/liter; cholesterol, 161-365 mg/100 ml; cortisol, 1.5-18.5 µg/100 ml; glucose, 41-151 mg/100 ml; and total protein, 2-6 g/100 ml. (Authors)

12730. Fagerlund, U. H. M. (Fish. Res. Bd. Can., Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1970. RESPONSE TO MAMMALIAN ACTH OF THE INTERRENAL TISSUE OF SOCKEYE SALMON (Oncorhynchus nerka) AT VARIOUS STAGES OF SEXUAL MATURATION. J. Fish. Res. Bd. Can., 27(6): 1169-1172.

Cortisol concentrations in response to an intra-arterial dose of ACTH were determined in plasma of sockeye salmon in which endogenous corticotrophin secretion had been suppressed with dexamethasone. Maximum concentrations were found 3 or 5 hr after the injection. Sexual maturation did not bring about a statistically significant change in maximum response. Cortisol maxima of males were 55-62% of those of females. (Auth.)

12731. Hoffman, Glenn L. (Eastern Fish Disease Lab., Leetown (P. O. Kearneysville, West Virginia). 1970. CONTROL AND TREATMENT OF PARASITIC DISEASES OF FRESHWATER FISHES. U. S. Dept. of Interior, Div. of Fishery Research, Fish Disease Leaflet No. 28, 7 p.

A compilation of the most effective methods of treating parasitic diseases of freshwater fishes.

12732. Baldwin, Wayne J. (Hawaii Inst. of Mar. Biol., Univ. of Hawaii, Honolulu, Hawaii). 1970. OXYGENATING DEVICE FOR LIVE-BAIT WELLS. J. Fish. Res. Bd. Can., 27(6): 1172-1174.

Details are given for the construction of a device for oxygenating live-bait wells and holding tanks. The unit is made from a 6-inch grinding wheel mounted in a stainless steel clamp. A 240-ft^3 cylinder of industrial oxygen is used as the source of supply. The oxygen, released as small bubbles, is controlled by a pressure regulator on the oxygen cylinder. The oxygen flow rate at 5-35 psi was determined and the size of bubbles measured. (Auth.)

12733. Symons, J. M., S. R. Weibel, and G. G. Robeck. 1966. INFLUENCE OF IMPOUNDMENTS ON WATER QUALITY - A REVIEW OF LITERATURE AND STATEMENT OF RESEARCH NEEDS. PHS Publ. No. 999-WP-18, October 1964, revised January 1966, 78 pp.

The current and pertinent literature on a wide variety of subjects relating to reservoir water quality is here summarized in one document. At the end of each subsection, some of the gaps in knowledge and suggested research on that topic are noted. Although this summary has not been revised since January 1966, and several important papers have been published since then, it still gives a good overall view of the subject area. (Authors)

12734. Symons, J. M., S. R. Weibel, and G. G. Robeck. 1965. IMPOUNDMENT INFLUENCES ON WATER QUALITY. Jl. Amer. Water Works Assoc., 57, No. 1, 51-75.

This paper reviews the necessity for research on water quality behavior and describes plans and early results in five research areas. These are: 1) the simulation of stratified reservoirs on a laboratory scale, 2) the rate and extent of the dissolution of iron and manganese from bottom muds in stratified reservoirs, 3) the dissolved oxygen budget in reservoirs, 4) the possibility of artificial destratification of reservoirs, and 5) the biologic transformations of nitrogen in reservoirs. Of these five areas, only number 2 was not carried to completion. (Authors)

12735. Symons, J. M., W. H. Irwin, and G. G. Robeck. 1967. IMPOUNDMENT WATER QUALITY CHANGES CAUSED BY MIXING. Jl. Sanitary Eng. Div., Amer. Soc. of Civil Engineers, 93, SA2, 1-20.

This paper discusses data obtained during the summer of 1965. A raft-mounted mechanical pump was placed in a northern Kentucky lake with a volume just under 3,000 acre-feet. The influence of artificial destratification was measured on temperature, concentrations of dissolved oxygen, manganese, sulfide, four forms of nitrogen, and phosphorus, and number and type of algae. A nearby unmixed lake of similar size and shape was used as a control for the investigation. (From authors)

12736. Symons, J. M., W. H. Irwin, R. M. Clark, and G. G. Robeck. 1967. MANAGEMENT AND MEASUREMENT OF DO IN IMPOUNDMENTS. Jl. Sanitary Eng. Div., Amer. Soc. of Civil Engineers, 93, SA6, 181-209.

The theoretical basis for judgment of mechanical performance of any destratification device using "destratification efficiency" (DE) based on reservoir stability and "oxygenation capacity" (OC) is presented. (From authors)

12737. Robinson, E. L., W. H. Irwin, and J. M. Symons. 1969. INFLUENCE OF ARTIFICIAL DESTRATIFICATION ON PLANKTON POPULATIONS IN IMPOUNDMENTS. Trans. Kentucky Acad. of Science, 30, Nos. 1 and 2, 1-18.

This paper reports in detail on plankton data taken during 1965 and 1966 mixing experiments. The total algal counts, the counts of various types of algae-green, blue-green, and so forth — and the number of occurrences of various species of algae are reported. (Authors)

12738. Symons, J. M., W. H. Irwin, E. L. Robinson, and G. G. Robeck. 1967. IMPOUNDMENT DESTRATIFICATION FOR RAW WATER QUALITY CONTROL USING EITHER MECHANICAL OR DIFFUSED-AIR PUMPING. Jl. Amer. Water Works Assoc., 59, No. 10, pp. 1268-1291.

This paper discusses 1966 data on mixing with a diffused-air pump. Attention is given to the effect of mixing on temperature, nitrogen, phosphorus, algal populations, algal types, and the dissolved oxygen budget (including dissolved oxygen, reduced iron, reduced manganese, and sulfides). The influence of multiple mixing with a diffused-air system in 1966 is contrasted with single mixing with a mechanical pump in 1965 for these six parameters. In addition, the usefulness of calculating the "destratification efficiency" is discussed. These two parameters are calculated for this equipment and are compared to other values reported in the literature. (From authors)

12739. Symons, J. M., W. H. Irwin, and G. G. Robeck. 1968. CONTROL OF RESERVOIR WATER QUALITY BY ENGINEERING METHODS. In: Proc. Specialty Conf. on Current Research into the Effects of Reservoirs on Water Quality. R. A. Elder, P. A. Krenkel, and E. L. Thackston, Eds. Tech. Rep. No. 17. Dept. Environmental and Water Resources Engineering, Vanderbilt Univ., Nashville, Tennessee, pp. 335-390.

This paper reports in detail the influence of mixing on 18 water quality parameters. The parameters measured were temperature, concentrations of dissolved oxygen, sulfide, iron, manganese, chemical oxygen demand, ammonia nitrogen, nitrate nitrogen, organic nitrogen, dissolved phosphorus, phytoplankton, hydrogen ions (pH), carbon dioxide, calcium, alkalinity, magnesium, sulfate, and conductivity. (From authors)

12740. Mulkana, Mohammed Saeed. 1966. THE GROWTH AND FEEDING HABITS OF JUVENILE FISHES IN TWO RHODE ISLAND ESTUARIES. Grad. School of Oceanog., Narragansett Mar. Lab. of Univ. of Rhode Island Collected Reprints, Vol. 5, 1966-67, pp. 563-633; Reprint from: Gulf Research Reports, 2(2): 97-168.

The purpose of this work was to gain information on the role of lower Pettaquamscutt River and lower Point Judith Pond, R. I. as nursery grounds for young migrant and resident species of fishes. Seining was conducted in summer and fall of 1962. Thirty-six species occurred in the lower river; 24 in the lower pond. The behavior of Pseudopleuronectes americanus and Brevoortia tyrannus is discussed. P. americanus grew 10 mm per month in both estuaries. B. tyrannus from the lower river grew at twice the rate of those from the lower pond. Juvenile Menidia menidia grew faster at seaward stations in both areas, especially the lower river. Forty-three types of prey organisms were identified from stomach contents of P. americanus; 39 from M. menidia. Stomachs were markedly full for both areas, although less for the lower pond. Comparison of abundance, growth and food habits reveals the two estuaries to be suitable nursery grounds, especially the lower river. -- Robert M. Howland

12741. Kuhns, William J., Ross F. Nigrelli, and Joseph V. Chuba (Dept. of Pathology, New York Univ. School of Medicine, New York, N. Y.). 1969. EFFECTS OF TEMPERATURE UPON "NATURALLY OCCURRING" BLOOD GROUP AGGLUTININS IN FRESH WATER CATFISH. J. Immunol., 103(1): 62-65.

"Naturally occurring" isohemagglutinins and heterophilic agglutinins in 10 fresh water catfish (Ictalurus nebulosus, Le Sueur, and Ictalurus catus, Linneaus), disappeared from circulating blood following a decrease in storage temperature from 25°C to 5°C. They reappeared subsequent to an increase in storage temperature from 5°C to 25°C. The changes in agglutinating activity were accompanied by corresponding alterations in total body weight, total serum proteins and in certain electrophoretic components. It is suggested that the change in immunologic status is but one reflection of general metabolic shifts associated with fluctuations in ambient temperature. (Authors)

12742. Kuhns, William J., Ross F. Nigrelli, and Joseph V. Chuba (Dept. of Pathology, N. Y. Univ. School of Medicine, New York, N. Y.). 1969. DIFFERENCES BETWEEN POPULATIONS OF FRESH WATER CATFISH DEFINED BY BLOOD GROUP ANTIGENS AND ANTIBODIES. J. Immunol., 103(3): 454-459.

The presence of cross-reacting hemagglutinins in fresh water catfish maintained under laboratory conditions enabled a classification of the fish into two distinct groups. The erythrocytes and serum from groups I and II used as reagents in testing other individuals permitted similar distinctions in catfish obtained from several different sources. The agglutinogen in erythrocytes from group I individuals was A-like in nature, based upon agglutination studies using lima bean lectin and human anti-A hemagglutinins; it also possessed Forssman-like activity as inferred from differential absorption studies using guinea pig kidney and bovine erythrocytes. The demonstration that hemagglutinins in group II sera were highly cross-reactive with human erythrocytes, including A_1 and A_1B, thus suggested a basis for interactions with group I red cells. The basis for a reciprocal effect, namely agglutination of group II cells by group I sera, was less clear, but may be related to the widespread reactivity of these sera against all human erythrocytes tested. (Authors)

12743. Chuba, Joseph V., William J. Kuhns, and Ross F. Nigrelli (Dept. of Pathology, N. Y. Univ. School of Medicine and the Osborn Laboratories of Mar. Sci, N. Y. Aquarium, N. Y. Zool. Soc., Brooklyn, New York). 1968. THE USE OF CATFISH, Ictalurus nebulosus (Le Sueur), AS EXPERIMENTAL ANIMALS FOR IMMUNIZATION WITH HUMAN SECRETOR SALIVA AND OTHER ANTIGENIC MATERIALS. J. Immunol., 101(1): 1-5.

Five of eight brown bullhead catfish surviving a 6-week series of three immunizing injections of human secretor saliva, mixed with Freund's complete adjuvant, produced high titered heteroagglutinins against human erythrocytes of all A-B-O types. Agglutination-inhibition and cell absorption tests indicated potent fractions of activity specific for human A, B, or O erythrocytes corresponding to the A-A-O group of the secretor saliva injected. Bullfrog erythrocytes with B-like specificity were agglutinated only by the hyperimmune plasma from the catfish injected with group B saliva. Sheep erythrocytes were weakly hemolyzed but not agglutinated by the catfish plasma specimens. The usefulness of the brown bullhead catfish, both from the point of view of the quantities of blood obtainable by repeated bleedings, as well as the immunologic competence of the species to produce specific high titered antibodies in response to injected antigenic materials of major interest in human blood group studies, has been clearly established. (Authors summ.)

12744. Krüger, F. W., G. Walker, and M. Wiessler (Inst. für experimentelle Toxikologie und Chemotherapie, Deutsches Krebsforschungszentrum, Heidelberg, Germany). 1970. CARCINOGENIC ACTION OF DIMETHYLNITROSAMINE IN TROUT NOT RELATED TO METHYLATION OF NUCLEIC ACIDS AND PROTEIN IN VIVO. Experientia, 26(5): 520-522.

For clarification of the relationship between carcinogenic and alkylating effect of dimethylnitrosamine, the formation of ^{14}C-7-methylguanine in the liver-RNA of pigeons, frogs, and trout after a dose of ^{14}C-dimethylnitrosamine was studied. As a result, ^{14}C-7-methylguanine could be detected in the liver-RNS of pigeons and frogs, while RNA, DNS and protein of the liver in trout were not marked. (Authors summ.)

12745. Potter, I. C., and B. Rothwell (School of Biol. Sci., Bath Univ. of Technol., Bath, Somerset, England). 1970. THE MITOTIC CHROMOSOMES OF THE LAMPREY, Petromyzon marinus L. Experientia, 26(4): 429-430.

Study of the somatic chromosomes of the lamprey, Petromyzon marinus L. has shown that the diploid chromasomal equipment of this species is composed of 168 very small chromosomes, of which some of the largest are metacentric. The figure seems to represent the largest number of chromosomes found in a vertebrate species. The chromosomes of P. marinus are compared with those of other lamprey species. (Authors summ.)

12746. Fugelli, K. (Inst. of Zoophysiol., Univ. of Oslo, Blindern, Oslo, Norway). 1970. GAMMA-AMINOBUTYRIC ACID (GABA) IN FISH ERYTHROCYTES. Experientia, 26(4): p. 361.

It is shown that gamma-aminobutyric acid and taurin, in the three species of flatfish studied (flounder, plaice, dab), are the most important intra-erythrocytic free amino acids. (Auth. summ.)

12747. Lighthill, M. James (Cambridge Univ., Cambridge, England). 1970. HOW DO FISHES SWIM? Endeavor, 29(107): 77-83.

The methods whereby fishes swim are by their very familiarity of deceptive simplicity. The author, himself an aerodynamicist of distinction, provides a systematic survey of the evolution of swimming methods in fishes. He given an analysis in simple mathematical terms of the dynamics of fish motion and shows how in their quest for improved efficiency and speed some fishes have acquired modifications of their tail and fin structures that conform to best aerodynamical practice. -- Journal

12748. West, Jerry L. (North Carolina Coop. Fishery Unit, Dept. of Zool., N. C. State Univ., Raleigh, North Carolina). 1970. THE GONADS AND REPRODUCTION OF THREE INTERGENERIC SUNFISH (FAMILY CENTRARCHIDAE) HYBRIDS. Evolution, 24(2): 378-394.

Sunfish hybrids were studied to determine if they possessed hybrid sterility. Warmouth female X bluegill male was fertile; mean fecundity was 18,200 eggs. Warmouth female X largemouth bass male and the reciprocal were sterile; ovaries were immature and later stages of oogenesis were scarce. Also, in the male later stages of spermatogenesis were absent. It was concluded that there are no isolating mechanisms which prevent the development of the embryo in crosses between the warmouth and black bass. The operative isolating mechanisms appear to be seasonal and behavioral. Hybrid sterility prevents the exchange of genes between these two species if mating occurs. It was also concluded that there are no isolating mechanisms which prevent the development of the embryo in crosses between the warmouth female and bluegill male. Hybrid sterility is not an isolating mechanism separating these two species. (From auth. summ.)

12749. Tyler, A. V. (Fish. Res. Bd. Can. Biol. Sta., St. Andrews, New Brunswick, Canada). 1970. RATES OF GASTRIC EMPTYING IN YOUNG COD. J. Fish. Res. Bd. Can., 27(7): 1177-1189.

Stomachs of young cod were opened at various time intervals after they had voluntarily eaten measured meals. More digested food left the stomach in the first few hours after the meal was given than towards the end of digestion. Instantaneous depletion rate increased rapidly with increase in acclimation temperature from 2 to 15 C. The rate was not increased at 19 C and was possibly depressed. Fish would not feed at 21 C. When meal size was varied, a straight-line relation was found between rate of gastric emptying and quantity of food in the stomach. This implies that in young cod intestinal absorption is coupled to food intake by regulation of the gastric volume. It is likely that digestion rate data could be used to estimate daily rations for fish in their own environment by measuring quantity of food in the stomach. (Auth.)

12750. Grigg, Gordon C. (Zool. Bldg., Univ. of Sydney, Sydney, Australia). 1970. USE OF THE FIRST GILL SLITS FOR WATER INTAKE IN A SHARK. J. exp. Biol., 52(3): 569-574.

The use of the first gill slits as an alternate or accessory route for the intake of respiratory water in the Port Jackson shark is described. This pattern of ventilation is an effective means of oxygenating the blood, but not as effective as normal respiration using the mouth. The use of the first gill slits for water intake is thought to allow respiration to continue during either the crushing of food or obstruction of the mouth while scavenging for food on the bottom. This therefore provides an interesting parallel with the use of the spiracles in skates and rays. (Auth. summ.)

12751. Dill, L. M., and T. G. Northcote (Inst. of Animal Resource Ecol., Univ. of Brit. Columbia, Vancouver, Brit. Columbia, Canada). 1970. EFFECTS OF GRAVEL SIZE, EGG DEPTH, AND EGG DENSITY ON INTRAGRAVEL MOVEMENT AND EMERGENCE OF COHO SALMON (Oncorhynchus kisutch) ALEVINS. J. Fish. Res. Bd. Can., 27(7): 1191-1199.

In experimental aquaria with large gravel (3.2-6.3 cm), vertical and lateral movements of coho salmon (Oncorhynchus kisutch) alevins were more extensive and area utilized per alevin was greater than in small gravel (1.9-3.2 cm). At low density (50 per aquarium) the alevins moved farther towards the inlet, but the mean area occupied per alevin was the same as that at high density (100 per aquarium). Burial depths tested (20 and 30 cm) had no significant effect on vertical or lateral movements or on area utilized per alevin. Alevin orientation in the gravel, survival to emergence, and timing of emergence were not affected by any of the environmental variables examined. (Authors)

12752. Lister, D. B., and H. S. Genoe (Resource Devel. Branch, Fish. Serv., Dept. of Fisheries and Forestry of Canada, Vancouver, Brit. Columbia, Canada). 1970. STREAM HABITAT UTILIZATION BY COHABITING UNDERYEARLINGS OF CHINOOK (Oncorhynchus tshawytscha) AND COHO (O. kisutch) SALMON IN THE BIG QUALICUM RIVER, BRITISH COLUMBIA. J. Fish. Res. Bd. Can., 27(7): 1215-1224.

Habitat distributions of chinook and coho salmon underyearlings in the Big Qualicum River, Vancouver Island, B. C., under controlled flow conditions indicated that at similar sizes their habitat requirements during the first 3 months of stream life were similar. Just after emergence, fry of both species occupied marginal areas in association with bank cover. With increased size, the young fish moved into habitat of progressively higher velocity. However, differences between the species in time of emergence and size evidently resulted in a high degree of spatial segregation. Chinook fry emerged about a month earlier than coho, were larger upon emergence, and grew at a faster rate. Apparently, because of their larger size at a given time, chinook preferred higher velocity locations than coho. (Authors)

12753. van Olst, Jon C., and John R. Hunter (Bur. of Comm. Fish., Fishery-Oceanography Center, LaJolla, California). 1970. SOME ASPECTS OF THE ORGANIZATION OF FISH SCHOOLS. J. Fish. Res. Bd. Can., 27(7): 1225-1238.

The objective of this study was to describe the organization of schools of the pelagic marine fishes Scomber japonicus, Trachurus symmetricus, Engraulis mordax, Atherinopsis californiensis, and Atherinops affinis. Organization was studied in larval through adult stages by analysis of spatial and angular relations among fish in dorsal photographs of schools. In all species, schools of young fish, larval and juveniles, were typically less compact and showed greater differences in angular headings than did schools of adult fish. The rate at which school structure changed with size varied among species. Analysis of the distances between neighbors in the four species indicated that fish were closer to adjacent neighbors in the file than they were to ones in rank. This suggested that spacing in the horizontal plane might be related to tail movement. (From authors)

12754. Zyblut, E. R. (Dept. of Recreation and Conserv. of Brit. Columbia, Fish and Wildl. Br., Victoria, Brit. Columbia, Canada). 1970. LONG-TERM CHANGES IN THE LIMNOLOGY AND MACROZOOPLANKTON OF A LARGE BRITISH COLUMBIA LAKE. J. Fish. Res. Bd. Can., 27(7): 1239-1250.

Macrozooplankton distribution and abundance as well as limnological conditions were compared during 1949 and 1964 in Kootenay Lake, a large oligotrophic lake in southeastern British Columbia. The standing crop of macrozooplankton increased two- to three-fold over 15 years. Changes in physical-chemical limnological conditions, such as a decrease in depth of light penetration, and increases in pH, specific conductivity, dissolved nutrients, and phosphates also occurred, indicating an increase in productivity. The most noticeable change in macrozooplankton was shift in cladoceran species composition in the north arm of the lake,

formerly dominated by Daphnia but now by Diaphanosoma. Size-selective predation, differences in food availability, and competition for food with Diaphanosoma and Mysis relicta are suggested to be responsible for changes in the spatial distribution of Daphnia since 1949. Examination of changes in midsummer zooplankton abundance between successive years (1964-66) indicated that total zooplankton was least abundant in 1964. Differences in abundance during this period were small when compared with those between 1949 and 1964. (Auth.)

12755. Arthur, John W., and Edward N. Leonard (U. S. Dept. of the Interior, Fed. Water Poll. Contr. Admn., Nat. Water Qual. Lab., Duluth, Minnesota). 1970. EFFECTS OF COPPER ON Gammarus pseudolimnaeus, Physa integra, AND Campeloma decisum IN SOFT WATER. J. Fish. Res. Bd. Can., 27(7): 1277-1283.

Three invertebrate species were subjected to acute (96-hr), followed by long-term (6-week) copper exposures under continuous-flow bioassay conditions. Survival, growth, reproduction, and feeding were the responses used for measuring toxicant effects. The average 96-hr median tolerance limits (TL_m) values for Campeloma decisum, Physa integra, and Gammarus pseudolimnaeus were 1.7, 0.039, and 0.020 mg/liter total copper, respectively. The total copper concentration having no effect after 6 weeks exposure for all three species was between 8.0 and 14.8 µg/liter. The newly hatched amphipods obtained from the second 6-week study were exposed to copper for 9 additional weeks, and grew to the adult stage only in copper concentrations $\leq$ 4.6 µg/liter. After 5 weeks exposure to a water system, survival of newly hatched Gammarus was markedly reduced when copper concentrations were between 12.9 and 6.2 µg/liter. (Authors)

12756. Amend, Donald F., and Velma C. Chambers (Bur. of Sport Fish. and Wildl., Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Washington). 1970. MORPHOLOGY OF CERTAIN VIRUSES OF SALMONID FISHES. I. IN VITRO STUDIES OF SOME VIRUSES CAUSING HEMATOPOIETIC NECROSIS. J. Fish. Res. Bd. Can., 27(7): 1285-1293.

An electron microscope study was performed on three virus isolates that caused hematopoietic necrosis in salmonid fishes: infectious hematopoietic necrosis (IHN), Oregon Sockeye Disease (OSD), and Sacramento River Chinook Salmon Disease (SRCD). All three isolates were examined by negative staining of fathead minnow (FHM) monolayer tissue culture concentrates and IHN virus was also examined in thin sections of FHM cells. Virus-like particles were observed in infected tissues, but similar structures were not found in uninfected cultures. All these isolates were bullet-shaped, but oval and truncated forms were also observed. Mean measurements of particles from IHN-virus-infected tissue were 158 x 90 mµ. They consisted of an outer coat 15 mµ thick, a core 60 mµ in diameter, subunits about 5 mµ, and an axial pore about 20 mµ in diameter. These particles also were seen budding from the cytoplasmic membrane. Similar particles from SRCD were 159 x 90 mµ and isolates from OSD were 181 x 91 mµ. The three isolates were morphologically indistinguishable from one another and the greater length of OSD was considered insignificant. IHN, SRCD, and OSD viruses were tentatively placed in the rhabdovirus group, but serological studies are needed to determine if they are antigenically identical or should be included as separate members. Biochemical and physical characteristics of these viruses and a comparison with other salmonid viruses is also discussed. (Authors)

12757. Smith, Lynwood S., and Timothy W. Newcomb (Fish. Res. Inst., College of Fisheries, Univ. of Washington, Seattle, Washington). 1970. A MODIFIED VERSION OF THE BLAZKA RESPIROMETER AND EXERCISE CHAMBER FOR LARGE FISH. J. Fish. Res. Bd. Can., 27(7): 1321-1324.

A tube-within-a-tube respirometer has been built in which a jet outboard impeller propels the water. A towline attached to the fish through its dorsal musculature to keep it out of the pump avoids the electrolysis problems of an electric grid when using sea water. (Authors)

12758. Saunders, Richard L., and Eugene B. Henderson (Fish. Res. Bd. Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1970. INFLUENCE OF PHOTOPERIOD ON SMOLT DEVELOPMENT AND GROWTH OF ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Can., 27(7): 1295-1311.

Atlantic salmon (Salmo salar) subjected in the spring to a constant photoperiod of 13 hr light/day or to simulated natural photoperiod (increasing day length) smoltified and grew rapidly before and after entering sea water. Others subjected to the reciprocal (complement) of natural photoperiod (decreasing day length in the spring) had the silvery color of smolts and grew rapidly but, unlike smolts, developed high condition factors while in fresh water. After they were transferred to sea water these fish ate less, grew more slowly, and had lower efficiences of food conversion than those subjected to natural and constant photoperiod. Salmon experiencing reciprocal photoperiod had decreased sensitivity to external stimuli, suggesting reduced thyroid activity. Histological studies in June showed no differences in the appearance of the thyroid glands, suggesting no difference in thyroid activity between groups in natural and reciprocal photoperiod. Nor was there any difference in plasma osmotic and chloride levels between natural and reciprocal photoperiod groups, either in routinely active or fatigued fish. It is suggested that photoperiod acts through the endocrine system to affect growth patterns during and after smolting and possibly certain aspects of the smolting process itself. Effects of photoperiod on smolting and growth of salmon are discussed in connection with other cyclical changes in salmonid physiology known to be influenced by photoperiod. (Authors)

12759. Becker, C. Dale (Ecosystems Dept., Battelle Mem. Inst., Pacific Northwest Labs., Richland, Washington). 1970. MARINE TREMATODE Tubulovesicula lindbergi (DIGENEA: HEMIURIDAE) FROM RESIDENT WHITE STURGEON IN THE COLUMBIA RIVER. J. Fish. Res. Bd. Can., 27(7): 1313-1316.

12760. Threlfall, William, and George Hanek (Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1970. METAZOAN PARASITES, EXCLUDING MONOGENEA, FROM LONGNOSE AND WHITE SUCKERS. J. Fish. Res. Bd. Can., 27(7): 1317-1319.

Seven genera of helminths (two of Digenea, one of Cestoda, and two each of Nematoda and Acanthocephala) and one species of parasitic copepod were recovered from 40 longnose suckers (Catostomus catostomus) and five white suckers (Catostomus commersoni), caught at two localities in Labrador, during August and September 1969. The helminths reported include five new host records. (Authors)

12761. Tsuyuki, H., and A. P. Ronald (Fish. Res. Bd. Can., Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1970. EXISTENCE IN SALMONID HEMOGLOBINS OF MOLECULAR SPECIES WITH THREE AND FOUR DIFFERENT POLYPEPTIDES. J. Fish. Res. Bd. Can., 27(7): 1325-1328.

The approximate equivalence of tryptic fragments and total basic amino acids per molecule of hemoglobin in five species of Pacific salmon, and the demonstration in sockeye salmon (Oncorhynchus nerka) of three or four electrophoretically distinct polypeptides in each of six major hemoglobin fractions separated by starch-gel electrophoresis, provided strong evidence for the in vivo existence in salmonids of molecular species of hemoglobins consisting of three and four different polypeptides. At least eight electrophoretically distinct polypeptides, including forms allelic to both the α- and β-type proteins, were found, accounting for the presence of large numbers of molecular species of hemoglobins and providing further evidence for the tetraploid origin of most salmonids. (Authors)

12762. U. S. Dept. of Interior, Division of Fishery Research. 1970. PROGRESS IN SPORT FISHERY RESEARCH 1969. U. S. Dept. of Interior, 284 p., illus., $2.00 per copy from Supt. of Documents, U. S. Govt. Printing Office, Washington, D. C. 20402.

12763. Packer, Randall K., and William A. Dunson (Dept. of Biol., The Pennsylvania State Univ., University Park, Pennsylvania). 1970. EFFECTS OF LOW ENVIRONMENTAL pH ON BLOOD pH AND SODIUM BALANCE OF BROOK TROUT. J. exp. Zool., 174(1): 65-71.

Brook trout (Salvelinus fontinalis) exposed to a low environmental pH (3.0-3.3) showed a drop in mean blood pH from 7.39 to 6.97. Trout at an environmental pH of 3.5 lost 50% of their total body sodium. Control sodium influx (72.5 μmoles/100 g hours) decreased to zero between pH 3.0 and 4.9 as Na efflux increased markedly over control levels. There was no significant difference in body Na content of wild trout from three streams ranging in pH from 6.05 to 7.10. Trout survived 13.1 to 14.7 hours in a 150 mM Na solution of pH 3.5 as compared to 2.5 to 4.9 hours at 100 μM Na and the same pH. The inability of brook trout to live in waters of pH less than about five, seems to be related to a drop in blood pH caused by the high hydrogen ion concentration of the medium. The loss of body Na appears to be of secondary importance as a cause of death. (Authors)

12764. Whitt, Gregory S., and Gary M. Booth (Dept. of Zool., Univ. of Illinois, Urbana, Illinois). 1970. LOCALIZATION OF LACTATE DEHYDROGENASE ACTIVITY IN THE CELLS OF THE FISH (Xiphophorus helleri) EYE. J. exp. Zool., 174(2): 215-224.

The swordtail (Xiphophorus helleri) eye contains the A_4 and B_4 isozymes of lactate dehydrogenase (LDH) as do all vertebrates and in addition contains a distinctive lactate dehydrogenase, the E_4 isozyme, found only in fish. LDH in the fish eye is located predominantly in the neural retina, especially in the inner segments of the photoreceptor cells. This neural retinal LDH activity consists mainly of the B_4 and E_4 isozymes which are more resistant than the A_4 isozyme to inhibition by 1.8 M urea. The sclera, cornea, and lens possess mainly the urea-sensitive A_4 isozyme. The specific cellular location of the E_4 isozyme suggests that it plays a role in the biochemistry of vision. (Authors)

12765. Wuntch, Thomas, and Erwin Goldberg (Dept. of Biol. Sciences, Northwestern Univ., Evanston, Illinois). 1970. A COMPARATIVE PHYSICO-CHEMICAL CHARACTERIZATION OF LACTATE DEHYDROGENASE: ISOZYMES IN BROOK TROUT, LAKE TROUT AND THEIR HYBRID SPLAKE TROUT. J. exp. Zool., 174(3): 233-251.

Peptide maps and amino acid composition of LDH crystallized from skeletal muscle extracts of brook trout (Salvelinus fontinalis) and lake trout (S. namaycush) are similar to those of the hybrid splake trout. The molecular weights are identical to mammalian LDH on the basis of sucrose density gradient centrifugation. The five A^1-A isozymes are restricted to LDH from trout muscle and migrate very slowly toward the anode. The B^1-B subunit series of isozymes are ubiquitous in trout tissues, although cell specific proportions of isozymes occur. While the A^1-A subunit genes must be present in all trout cells, they are active only in the muscle where their products are responsible for essentially all of the LDH activity in this tissue. Extracts from heart, muscle, and liver tissues were utilized to characterize and compare the duplicated subunit tetramers of LDH in terms of several physico-chemical and physiological parameters. Homologies of trout LDH isozymes with those of higher vertebrates are discussed in relation to these data. (From authors)

12766. Garey, W. F., and H. Rahn (Dept. of Physiol., School of Medicine, State Univ. of New York, Buffalo, New York). 1970. GAS TENSIONS IN TISSUES OF TROUT AND CARP EXPOSED TO DIURNAL CHANGES IN OXYGEN TENSION OF THE WATER. J. exp. Biol., 52(3): 575-582.

Tissue gas-tension analyses in carp and rainbow trout were performed over long enough periods to establish a positive correlation with changes in water O_2 tension. For the trout, there is a parallelism between the O_2 tensions of water and tissue although the latter appears to lag by approximately 4 hr. The O_2 tensions in the carp do not show any cyclic changes, and their values are distinctly less than those for the trout. -- Robert M. Howland

12767. Ling, Victor, and Gordon H. Dixon (Dept. of Biochem., Univ. of Brit. Columbia, Vancouver, B. C., Canada). 1970. THE BIOSYNTHESIS OF PROTAMINE IN TROUT TESTIS. II. POLYSOME PATTERNS AND PROTEIN SYNTHETIC ACTIVITIES DURING TESTIS MATURATION. J. biol. Chem., 245(12): 3035-3042.

Protamines are synthesized in the cytoplasm of rainbow trout (Salmo gairdnerii) spermatid cells. Following a pulse of ^{14}C-arginine, the majority of the labeled nascent protamine is found on diribosomes (disomes) sedimenting at 120S. Polysome profiles obtained at various times during testis maturation, which, in this species, takes place from September to December, show the appearance of high concentrations of such disomes during the period of rapid protamine synthesis. This effect is not observed in trout liver polysomes isolated under the same conditions, the polysome profiles being independent of the sexual maturation of the fish. Spermatid cell disomes are not disaggregated by lowering Mg^{++} concentration during isolation or by the addition of pancreatic ribonuclease. Pulse-chase experiments with ^{14}C-arginine show that disomes are labeled more rapidly than heavier polysomes. The distribution of incorporated ^{14}C-arginine and ^{14}C-lysine through the polysome profiles changes markedly during the maturation of the testis; at the time of rapid protamine synthesis, the disomes incorporate arginine rapidly but lysine slowly, suggesting that they are largely engaged in protamine synthesis. Actinomycin D has an inhibitory effect on the incorporation of ^{14}C-arginine into protamine only during the early protamine stage of development, suggesting that messenger RNA for protamine is synthesized before protamine synthesis takes place and is metabolically stable. (Authors)

12768. Peterson, Hans H. (Bergeforsen Hydro-Electric Co., Sorberge, Sweden). 1968. THE GRAYLING, Thymallus thymallus (L.) OF THE SUNDSVALL BAY AREA. Inst. of Freshwater Res., Drottningholm, Sweden, No. 48, pp. 36-56.

The grayling is a common fish in the rivers as well as in brackish water along the coast in northern Sweden. It has not been possible to show a real difference between an entirely river-living population on the one hand and a coast-living but river-spawning population on the other. The habitat, growth, food, and drift of the young grayling are discussed. The growth is rather rapid and uniform up to an age of 5-6 years. Very young fish, 1+ and 2+, dominate the angler's catch. The dominating food is terrestrial insects in younger fish and large insect larvae in older fish. There is a spawning migration in the coast-living population but after the spawning the fish can remain in the river for more than one year. (Auth.)

12769. Potts, W. T. W., Margaret A. Foster, and J. W. Stather (Dept. of Biol. Sciences, Univ. of Lancaster, St. Leonardgate, Lancaster, England). 1970. SALT AND WATER BALANCE IN SALMON SMOLTS. J. exp. Biol., 52(3): 553-564.

Salmon smolts adapted to sea water maintain a high rate of turnover of both sodium and chloride, but when adapted to fresh water the rate of turnover is low. Only a small part of the influx takes place through the gut. On immediate transfer from sea water to dilute sea water or to fresh water, the influxes decline rapidly, but on transfer from fresh water to sea water the restoration of the fluxes takes place slowly. The alternative hypotheses that the rapid changes are due to exchange diffusion or to rapid adjustments of the sodium pump are discussed. (Authors summ.)

12770. Grigg, Gordon C. (Zool. Bldg., The Univ. of Sydney, Sydney, Australia). 1970. WATER FLOW THROUGH THE GILLS OF PORT JACKSON SHARKS. J. exp. Biol., 52(3): 565-568.

It has been said that the presence of interbranchial septa in elasmobranchs prevents counter-current flow of water and blood at the respiratory surface. In contesting this opinion, attention is drawn to the importance of the septal canals as ducts carrying respiratory water in the Port Jackson shark. Observations made on the passage of dye through the gills and on water pressures in the orobranchial cavity, septal canals and parabranchial cavity, indicate that water flows

unidirectionally between the secondary lamellae and into the septal canals. This provides a counter-current flow between water and blood at the respiratory surfaces. (Auth. summ.)

12771. Robinson, John Wesley. 1966. OBSERVATIONS ON THE LIFE HISTORY, MOVEMENT, AND HARVEST OF THE PADDLEFISH, Polyodon spathula, IN MONTANA. Proc. of Montana Acad. of Sciences, 26: 33-44.

The paddlefish is native to the Missouri and Yellowstone Rivers of Montana. The average annual calculated growth increment of paddlefish collected at the Yellowstone River Intake Diversion Dam was 7.2 inches per year for ages 1 to 4, 2.9 inches for ages 5 to 11, and 0.5 inches for ages 12 to 25. The average calculated growth increment for all fish was 2.2 inches per year. Sex ratios varied according to collection site from 1.8:1 to 36.8:1, males to females. The fecundity of 4 paddlefish ranged from 82,397 to 269,043 eggs. Tagging studies indicate that paddlefish may migrate annually. In 1965, the total catch was 2,254 paddlefish weighing 25 tons. Of these, 1,143 fish weighing 12 tons were kept. Based on fish kept, the harvest was 55 percent less in 1965 than in 1964. The weight of individual paddlefish (1,818 specimens) caught in 1964, varied from 5.50 pounds to 42.00 pounds with an average of 21.97 pounds. In 1965, the weight of individual fish (1,229 specimens) ranged from 5.00 pounds to 46.00 pounds with an average of 21.86 pounds. There were about 55 percent less fishermen and 73 percent fewer fish caught in 1965 than in 1964. During both years about 60 percent fewer fish were caught in June than in May. The catch rate per fisherman trip was about 3 fish in 1964 and 2 fish in 1965. Most of the fishermen who took several paddlefish per trip kept only two even though there was no legal limit. -- Robert M. Howland

12772. Hill, William J. 1966. OBSERVATIONS ON THE LIFE HISTORY AND MOVEMENT OF THE GOLDEYE, Hiodon alosoides IN MONTANA. Proc. of Montana Acad. of Sciences 26: 45-53.

The goldeye is not exploited for sport or commercial purposes in Montana and is considered detrimental to more desirable fishes. A study was undertaken to gain knowledge about the goldeye which might be useful in its management. The study covered four collection areas on Fort Peck Reservoir, three on the Missouri River, three on the Marias River, two on the Teton River, and two on Belt Creek. Seven hundred and forty-seven specimens, age 1-8, ranged from 4.7 to 16.8 inches in total length (average 11.3) and from 0.03 to 2.08 pounds (average 0.42). The greatest growth was in the first 2 years of life. The oldest female goldeye collected in Montana was 8 years old, 16.3 inches long and weighed 1.34 pounds. The oldest male was 5 years old, 12.4 inches long, and weighed 0.54 pounds. The largest fish was a 7-year-old female, 16.8 inches long weighing 2.08 pounds. The sex ratio of males to females from all Montana areas combined was 1:1.1. The spawning period of goldeye in the Teton River in 1964 presumably occurred between April 17 and June 8. While most of the ripe males and females were 3 and 4 years old, respectively, a few males were 4 and a few females 3 years old. Actual egg counts were made on four fish from the Teton River, 1965, all of which were 4 years old. The total lengths and number of eggs for each fish were: 11.5 inches - 5,390; 12.0 - 6,241; 12.2 - 6,962; 12.8 - 6,855. For movement study, 2,221 specimens were marked with numbered yellow dart tags inserted below the dorsal fin. Only 37 marked fish were recaptured. The low number of returns for this species resulted from the lack of effort by fishermen. At least a few specimens were recaptured in each area where fish were marked. One male was caught 68 miles downstream, 13 days after release. One female was caught 75 miles upstream, 45 days after release, while another female was recaptured 30 miles upstream, 38 days after release. Others were recaptured close to the site of release. -- Robert M. Howland

12773. Robins, G. Lewis. 1970. A BIBLIOGRAPHY OF THE PIKE PERCH OF THE GENUS Stizostedion (INCLUDING THE GENUS KNOWN AS Lucioperca). Fish. Res. Bd. Canada Technical Report No. 161, 67 p.

12774. Gould, W. R., and C. J. D. Brown. 1966. THE DISTRIBUTION OF Hybognathus (CYPRINIDAE) IN MONTANA. Proc. of Montana Acad. of Sciences 26: 54-56.

The collections of Hybognathus at Montana State University were re-examined during 1964 and 1965 to more precisely define the distribution of each of the three species in Montana. -- Robert M. Howland

12775. Parsons, T. R. (Fish. Res. Bd. Canada, Nanaimo, Brit. Columbia, Canada). 1970. PLANKTON, POLLUTION AND FISH IN THE STRAIT OF GEORGIA. Western Fisheries, 80, No. 1, 18, 20, 43-44; Comm. Fish. Abstracts, 23(10): p. 6.

Because of the importance of the Strait of Georgia as a commercial fishery, scientists with the Fisheries Research Board of Canada have conducted a 5-year multidiscipline study of the area. They averaged six oceanographic surveys of the Strait each year, collecting data on the chemistry of the water and the abundance of plankton, fish larvae, and juvenile fish. In addition, they studied such areas as the Fraser River estuary and Saanich Inlet. Their primary goal was to learn as much as possible about the action of environmental factors on the early life of fish, particularly the factors that influence the abundance of plankton and its availability to the fish as food. From measurements on the concentrations of these food organisms, regulations for management of the fisheries can be evolved and predictions useful to the fishermen and the industry can be made. Several facts that were not directly related to the original program came to light during the investigation. For example, impressive numbers of anchovy larvae were collected during the surveys. A possible resurgence of this fishery may be indicated. Along the Fraser River Delta, a potential 50,000 to 100,000 tons per year of shrimplike plankton was estimated to be available for harvesting. A protein- and oil-rich resource of this magnitude could be come a rival of the U. S. brine-shrimp market, currently a multimillion dollar industry. The author concludes by pointing out that final analyses of the data may serve as the basis for a program that will preserve the natural environment of the Strait for future generations.

12776. Adam, N. C., and G. S. Spyropoulos. 1968. (STUDY OF THE QUANTITATIVE EXTRACTION OF PARATHION FROM FISH AND ITS DETERMINATION BY GAS CHROMATOGRAPHY AND OTHER METHODS). Annales de l'Institut Phytopathologique Benski 8, No. 4, 153-161; Food Sci. and Technol. Abstracts 2, No. 5, 722, 5R172 (May 1970); Comm. Fish. Abstracts, 23(10): p. 16.

Samples of homogenized cod were extracted with acetone, and the concentrated extract was purified by treatment with solvents and chromatographed on an alumina column with redistilled benzene as the eluting solvent. The conditions for measuring parathion in the extract are described. Using a 50 g. sample, the authors could detect 0.2 p.p.m. of parathion. They used the same extract to determine parathion by thin-layer chromatography, spectrophotometry, and colorimetry. Results obtained by the different methods are presented for cases when parathion was added to the cod extracts and when it was not.

12777. Anonymous. 1970. RESEARCH REPORTS. TROUT FEEDS. Feedstuffs 42, No. 26, 35 (June 1970); Comm. Fish. Abstracts, 23(10): p. 24.

Leo E. Orme, Chief of the Diet Testing Development Center, Spearfish Fishery Center, Spearfish, South Dakota, has reported the results of taste tests on rainbow trout fed one of four feeds for the last 120 days before being harvested. The feeds contained either fish or soy oil or were fortified with either chelated minerals or chelated iron. After being harvested, the fish were packed frozen, and shipped to another location. Then they were thawed, cooked, and evaluated for taste by a trained panel. Most of the 12 judges scored all four lots acceptable. The mean flavor scores were within a narrow range, the differences being insignificant except for those between trout fed fish oil and trout fed chelated minerals; this difference was significant at the 1% level. Since the trained panel could find no significant difference between the various lots of trout (with the exception noted),

the researchers feel confident that the average consumer will find no significant difference in the palatability of trout raised on any of the four feeds.

12778. Jenkins, C. E. (Battelle Mem. Inst., Pacific Northwest Lab., Richland, Washington). 1969. RADIONUCLIDE DISTRIBUTION IN PACIFIC SALMON. Health Physics 17, No. 3, 507-512; Food Science and Technol. Abstracts 2, No. 1, 127-128; Comm. Fish. Abstracts, 23(10): p. 26.

The following gamma-emitting radionuclides were detected and measured in four species of Pacific salmon: ^{54}Mn, ^{60}Co, ^{137}Cs, ^{226}Ra, ^{22}Na, ^{40}K, ^{46}Sc, ^{51}Cr, ^{57}Co, ^{59}Fe, ^{65}Zn, ^{88}Y, ^{110m}Ag, ^{140}Ba, ^{152}Eu, ^{203}Hg, and ^{208}Tl. The concentration of the first two decreased in muscle tissue of salmon caught from Northwest Alaska through Southern Alaska to the Washington-Oregon coast by factors of about 1.5 to 3 and 4.5 to 12, respectively. The concentration of ^{137}Cs decreased only about 25 percent. Concentrations of ^{226}Ra in the tissues of Alaskan salmon were high enough to cause natives who ate the fish to exceed their maximum permissible level. Among the factors affecting the distribution pattern of the radionuclides were the amount present in the Columbia River and the nuclear tests conducted by the Chinese. -- L. Baldwin

12779. Taniguchi, Nobuhiko, and Izumi Nakamura (Dept. of Cultural Fisheries, Fac. of Agric., Kochi Univ., Nangoku, Kochi Pref. 783, Japan). 1970. COMPARATIVE ELECTROPHEROGRAMS OF TWO SPECIES OF FRIGATE MACKEREL. Bull. Jap. Soc. sci. Fish., 36(2): 173-176; Comm. Fish. Abstracts, 23(10): p. 29.

Specific differences in two frigate mackerels, Auxis thazard and A. rochei, caught in Japanese waters were examined by the cellulose acetate electrophoretic method. The electrophoretic patterns of both species had five components, but the electropherograms of the muscle proteins of A. thazard showed no component D and those of A. rochei showed no B. The two species were clearly distinguishable by the percentage and the mobility of the components. This finding refutes that of Fraser-Brunner (1950) and of Rivas (1951) and confirms the conclusion of Fitch and Roedel (1963) that Auxis consists of two species.

12780. Seaman, Elwood A., H. W. Hays, C. R. Walker, R. E. Johnson, and J. G. Cummings (Bur. of Sport Fisheries and Wildlife, Washington, D. C.). 1969. REGISTRATION AND CLEARANCE OF CHEMICALS FOR FISH CULTURE AND FISHERY MANAGEMENT. Fish and Chemicals-A symposium held at the 99th Annual Meeting of the Amer. Fish. Soc., New Orleans, La., Sept. 12, 1969, 73 p.; Selected Water Resources Abstracts, 3(18): p. 40.

This symposium contains 4 papers. Three of these, by R. E. Johnson, J. G. Cummings, and H. W. Hays deal with the registration and clearance of chemicals used in fish culture and management. The fourth paper, by C. R. Walker on the problems in clearance and registration of chemicals used by fish culturists and fishery biologists, discusses the problem, gives information and current status of use and registration of chemicals. The chemicals discussed are classified into the groups: Herbicides, piscicides, disinfectants and pest control other than fish, external and internal therapeutic agents and anesthetics. -- Sjolseth and Katz

12781. Hurlbert, Stuart H., Mir S. Mulla, James O. Keith, William E. Westlake, and Margaret E. Dusch. (Calif. Univ. Dept. of Entomology and Bur. of Sport Fisheries and Wildlife, Davis, California). 1970. BIOLOGICAL EFFECTS AND PERSISTENCE OF DURSBAN IN FRESHWATER PONDS. J. econ. Ent., 63(1): 43-52; Selected Water Resources Abstracts, 3(18): p. 12.

Dursban (0, 0-diethyl 0-3, 5, 6-trichloro-2 pyridyl phosphoro-thioate) was applied in quadruplicate at two week intervals to small freshwater ponds at rates of 0.01, 0.05, 0.10, and 1.0 lb per acre. The total mortality of mallard ducklings was 42% on treated ponds and zero on control ponds. The rate of application and the mortality of birds showed no relationship. Except for the highest rate of application, the insecticide caused less than 10% mortality of caged mosquitofish. Fish exposed to 0.05 lb/acre treatment had Dursban residue of 0.1 ppm

two weeks after application. Reduction of Corisella population was approximately proportional to the rate of treatment. Several zooplankton species were markedly affected by the insecticide applied at higher rates. The residue of the chemical in vegetation declined rapidly from 26 ppm after 4 hours to 1.1 ppm after 7 days. -- Wilde

12782. Dorfman, Donald, and James Westman (Rutgers - The State Univ., New Brunswick, New Jersey). 1970. RESPONSES OF SOME ANADROMOUS FISHES TO VARIED OXYGEN CONCENTRATIONS AND INCREASED TEMPERATURES. Rutgers Univ., Water Resources Res. Inst., Partial completion and termination report, 75 p.; Selected Water Resources Abstracts, 3(18): p. 39.

Striped bass, Roccus saxatilis, white perch, Roccus americanus, American shad, Alosa sapidissima, blueback herring, Alosa aestivalis, and alewives, Alosa pseudoharengus, were studied to determine their survival, responses and growth in reduced concentrations of dissolved oxygen. The upper thermal limits and tolerances were also determined for striped bass, white perch and alewives. Diurnal concentrations of dissolved oxygen were provided at levels similar to those occurring in the Philadelphia - Camden region of the Delaware River. Special tanks were constructed for establishing gradients of dissolved oxygen.

12783. Tarr, H. L. A., and Joan Roy (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1966. INCORPORATION OF RADIOACTIVE COMPOUNDS INTO THE PURINE AND PYRIMIDINE BASES AND 2-DEOXYRIBOSE OF SALMON TESTES DEOXYRIBONUCLEIC ACID. Canad. J. Biochem, No. 44: 1435-1446; 1967 Studies, Part 1, Fish. Res. Bd. Can.Studies No. 1112, 15-26 pp.

Slices of immature salmon testes incorporated radioactive purine and pyrimidine bases and related nucleosides, deoxynucleosides, nucleotides, and deoxynucleotides into deoxyribonucleic acid (DNA). When DNA was extracted from the tissues and hydrolyzed, the purine and pyrimidine bases obtained were labeled in a manner which suggested that the radioactive substrates had been incorporated into DNA by recognized biosynthetic pathways involving "preformed" purines and pyrimidines and their derivatives. Since radioactive carbonate, glycine, and formine were not incorporated into the purines obtained from DNA, and radioactive formate only caused labeling of the thymine, it would appear unlikely that the de novo biosynthesis of purine and pyrimidine rings occurs in milts. C-1, C-6, and generally labeled glucose - ^{14}C caused labeling of the 2-deoxyribose, but not of the purines or pyrimidines, of DNA. Radioactive adenylic acid, deoxyuridilic acid, ribose 5-phosphate, and 5-phospho-α-D-ribofuranosyl-1-pyrophosphate also caused labeling of the 2-deoxyribose of DNA. (Authors)

12784. Brockerhoff, H., and R. J. Hoyle (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1967. CONVERSION OF A DIETARY TRIGLYCERIDE INTO DEPOT FAT IN FISH AND LOBSTER. Canad. J. Biochem., 45: 1365-1370; 1967 Studies, Part 2, Fish. Res. Bd. Canada Studies No. 1186, pp. 439-444, 1968.

Cod, trout, and lobsters were fed a triglyceride that contained oleic-9, 10-^{3}H acid in the β and oleic-1-^{14}C acid in the α positions. The distribution of the labels in the α and β positions of the depot fat was then analyzed. The original distribution had been retained to a large extent in the lobster, indicating a retention of the β-monoglyceride structure of the dietary fat in this invertebrate. In the fish, there was an apparent partial retention of ^{3}H in the β position, but the ^{14}C of the originally α-bound acids was now almost randomly distributed. These results may be interpreted as supporting the hypothesis that the β-monoglyceride structure of dietary fat is partly retained by fish. It is clear, however, that in fish, though not in lobster, the larger part of the fat had been broken down completely before deposition. (Authors)

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